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सत्यमेव जयते

REPORT OF THE PANEL ON SUGAR, ALCOHOL & FOOD YEAST INDUSTRIES

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सत्यमेव जयते

REPORT OF THE PANEL ON SUGAR, ALCOHOL AND FOOD YEAST.

A Panel was formed by the Government of India in the Department of Planning and Development to consider and make recommendations to them regarding the development of Sugar, Alcohol and Food Yeast Industries. The Panel consisted of the following :—

Sir Shri Ram (Chairman)
Mr. R. C. Srivastava, C.I.E.
Mr. Vishnu Sahay, I.C.S.
Mr. S. M. Dhar, C.I.E., I.C.S.
Dr. B. C. Guha, D.Sc., Ph.D.
Mr. Lalchand Hirachand.
Mr. M. B. Amin, Dipl. Ing.
Mr. W. H. A. Webb; B.Sc., A.M.I. Chem. E.
Dr. M.K. Maitra, Ph.D., D.I.C. (Secretary)

Messrs Shankar Prasad, I.C.S., Karam Chand Thapar and Gur Sharan Lal were subsequently co-opted as members of the Panel.

2. The following general and special dirctives were issued by the Government of India to indicate the scope of the panel and the procedure to be followed by it:—

GENERAL DIRECTIVE.

"It is the function of Panels to make recommendations to Government regarding the development of industries, both existing and new. These recommendations should be so framed as to enable Government to prepare a detailed phased plan for the five years following the cessation of hostilities as the first stage of a 15-year plan of industrial development for the whole country.

2. In order to assist them to formulate recommendations, Panels will be supplied, as far as possible, with factual information prepared by the Panel Secretaries. In the case of new industries, the information will consist of a general survey of the industry and the importance of starting it in India, the availability of raw material, the power requirements, the demands of the Indian markets and the probabilities ot exports. In the case of existing industries, the information will naturally be more comprehensive ; it will indicate, in addition, the location of existing units, the types of goods produced, the total production under each category and the assistance, if any given by Government. These items are to be regarded as illustrative and not exhaustive.

Government will give each Panel, as a basis, for discussion, the provisional target to be aimed at in the first five-year period and, wherever possible, of the target to be reached in 15 years.

3. The recommendations of the Panels should cover the following points :—

(1) The scope and extent of development, including the type of products recommended.

(2) Whether the industry should be under Government ownership either on ground of national interest or because private capital is unlikely to take it up, and if so whether it should be wholly or partly managed by Government.

(3) In the case of industries to be developed other than under State ownership, the capital required for such development, whether the whole of it is likely to be available by public investment and, if not, the extent to which Government assistance may be required.

(4) The extent to which technical advice from abroad may be necessary.

(5) The manner and the degree of co-operation with foreign firms considered necessary and desirable, both as regards capital and management.

(6) The location of the industry.

(7) The nature of the assistance required from Government in the form of protective duties, bounties, research grant, expert advice, etc.

(8) If the industry is to be under private ownership and management, what controls, if any, should be exercised by Government.

(9) What should be the organisation of the different units of the industry, e.g., should there be an industrial association? Would a cartel be desirable?

(10) The stages by which the industry should be developed.

(11) Should the industry cater for the export market?

(12) Should the industry be developed, as in Japan, on the cottage industry basis and if so, to what extent.

4. Although, as stated above, the Panels may recommend the grant of protection, it will not be their function to consider broad questions of international trade and commercial policy.

5. Joint meetings of the Panels should be held, wherever necessary, to secure co-ordination, particularly where the processes and the products of one industry are connected with those of another

6. Some of the panels have been drawn broadly and it may be necessary to co-opt members for dealing with specific branches of the industry. Members may be co-opted by the Chairman in consultation with the Industrial Adviser.

7. Before submitting recommendations, Panels should consult Provincial Industrial Committees, particularly in the matter of location of industry They should also, where the circumstances of the case require it, consult Industrial Committees in States or State Governments Durbars. The recommendations should be submitted to Government through the Industrial Adviser."

SUPPLEMENTARY DIRECTIVE.

"This directive is supplementary to the general directive to Panels.

The provisional target to be aimed at in the first five-year period and the targets to be reached in fifteen years are indicated below :—

	Five-year period.
Sugar ...	... (25% over existing production)
Power alcohol ...	... (20 million gallons)
Food Yeast ...	... (Not yet fixed)

In addition to the points mentioned in para 3 of the general directive, the recommendations of the panel should cover the following matters :—

(i) Whether the panel agrees to the appointment of an expert adviser (or Commissioner) with a comprehensive experience of the power alcohol industry to assist and advise Government.

(ii) Whether the Panel agrees to the appointment of an experienced firm or firms as Consultants for the power alcohol industry.

(iii) The possibility of producing power alcohol from sources other than molasses.

(iv) The best method of distributing the power alcohol produced, so as to make the fullest possible use of it.

(v) whether the sugar industry is over-developed at present in any region if so, whether the Panel has any suggestion on the subject.

(vi) What steps should be taken to make the Sugar industry efficient enough to be able to compete with Java in the export market.

(vii) Whether the Panel considers that the industry can stand on its own legs without a reduction in the present excise duty.

(viii) The possibility of manufacturing in India the Capital goods, particularly machinery, required by the Sugar, Alcohol and Food Yeast industries."

3. Preliminary notes on the Sugar Industry, Power Alcohol and Food Yeast were prepared and circulated amongst the members of the Panel before its first meeting.

4. The meetings of the Panel were held on the following days :—

The first meeting was held on the 21st May 1945 ;
The second meeting was held on the 9th & 10 July 1945 ;
The third meeting was held on the 13th & 14th August 1945 ;

On the morning of the 14th August a joint meeting of the Panel with the Agricultural Sub-committee of the Indian Sugar-cane Committee was held.

A draft report of the Panel was drawn up and this was taken up for consideration at the fourth meeting of the Panel held on the 4th January 1946.

The draft report of the Panel was forwarded to the Provincial Governments and the major Indian States. At a joint meeting of the panel with the representatives of the Provincial and State Governments and their Industrial committees held on the 7th February 1946, the various recommendations embodied in the draft report were fully discussed.

The fifth and final meetings of the Panel were held on the evening of the 7th February and on the 8th February, 1946.

5. The Panel is grateful to the Chairman for his able guidance of the deliberations at the meetings and for his constant interest and valued advice.

The Panel is greatly obliged to several officials and non-officials who have helped it with information and advice. It would not be possible to name them all individually. The Panel would, however, like to express its special obligations to Mr. S. Dikshit, officiating Sugar Controller for India, for the co-operation and valuable help he has rendered to the Panel.

THE SUGAR INDUSTRY.

6. The history of the modern Sugar Industry in India virtually begins from 1932 when the Government of India adopted a policy of giving tariff protection to it. In 1931-32 there were only 31 vacuum pan factories in India and they produced 1,58,000 tons of sugar. Now there are 154 with a normal production of 10,80,000 tons.

7. **Consumption before the war and now.**—Before the war India had become self-sufficient in respect of its sugar requirements ; indeed in certain years production was in excess of these. Imports were small and were mainly confined to maritime states. The average annual demand for internal consumption was 10,80,000 tons. It has since grown considerably owing to the general growth of population, the increase in industrial and urban population and improvement in war-time in the purchasing power of at least a section of the population, with consequent changes in their standard of living and habits. To these causes will soon be added the general impact on rural habits of the return of two million soldiers. The estimates made by the Governments of provinces and states and the Sugar Controller for India show that the present effective demand for sugar is about 50 per cent higher than in 1939. This is further substantiated by certain figures supplied by the Director, Cost of living Index, of the Labour Department of the Government of India about family budgets of working classes in urban areas. These indicate that the per capita consumption of sugar by these classes has during the war-time increased by about 60 per cent. It is. therefore, safe to assume that the internal demand in the country will in 1950 be 15,50,000 tons. This quantity would then provide roughly 24 lbs. per head per annum

for towns with a population of more than 5,000 and 6 lbs. for the rest of the country. The pre-war average consumption was over 6 lbs. per head and the figures of off-take in the towns which are rationed at present indicate that though consumption will vary widely from town to town and area to area, the above estimate of the overall demand is not too liberal. It, however, postulates that there will be no slump in the economy of the country, which is a premise we must accept for the purpose of our planning.

8. **Exports.**—It is desirable to have a normal annual provision of 50,000 tons for export to neighbouring countries. It is true that the cost of production of sugar in India is, at present, higher than in Java, our chief competitor. But we need export markets as a safety-valve for years of over-production and, for that reason, to maintain contact with them, even though export may be possible only at low prices and, therefore, at some cost to the local consumer. India should guard itself against a recurrence of the position in pre-war years when an International Agreement debarred it from exporting sugar on the grouud that it was normally not in a position to do so. But for this restriction it might have been possible for the industry in U. P. and Bihar to face the crisis due to overproduction in 1940 with lesser inconvenience to itself and the cane-growers. Further it is likely that as a result of improved agriculture and better efficiency in production we should, by the time we do have an exportable surplus, be producing sugar cheaper than at present.

9 **Production target** —It is, therefore, necessary to plan for an annual production of 16,00,000 tons for the period ending 1950. Considering the difficulties in estimating the social and economic conditions and the growth of population over a longer period, it would at present be safe and desirable to plan for only five years.

10. **Present production capacity.**—The theoretical production capacity of the existing vacuum-pan factories manufacturing sugar directly from cane is over 14,00,000 tons but the maximum production in any year was only 12,42,000 tons. The following figures show the average annual production in U P. and Bihar during the years 1937-38 to 1943-44 (excluding 1940-41 and 1941-42 when production in these provinces was artificially restricted) and in other areas from 1939-40 to 1943-44 :—

	Tons.
United Provinces	5,70,000
Bihar	2,31,000
Madras	35,000
Punjab	11,000
N.W.F.P.	5,000
Sind	3,000
Orissa	2,000
Bombay	80,000
Bengal	29,000
Indian States	1,18,000
	10,84,000

The normal capacity of the Indian Sugar Industry with its present location, equipment and efficiency and under existing conditions of agricultural economy and transport for sugarcane is, therefore, about 10,80,000 tons. It is expected, however, that by 1950 it will, by development of sugarcane, construction of roads in factory areas, shifting of certain units to more suitable sites, and improvement in manufacturing efficiency, increase by 1,70,000 tons to 12,50,000.

11. **Refineries producing sugar from cane gur & palmyra jaggery.**—There are some factories which produce white sugar by refining cane gur or Palmyra Jaggery. Their production in the past has been fitful and they have worked only in years in which the prices of Gur or Palmyra Jaggery were unduly low. The cane gur refineries have practically produced no sugar for some years. Those refining Palmyra Jaggery, not having to pay any excise duty, have done somewhat better. The total production during the last three years has averaged about 8000 tons annually and there is no prospect of any improvement in future. The production from this source, need not, therefore, be taken into account. Sugar produced by refining Palmyra Jaggery is at present exempted from the excise duty. The Panel is not clear what the justification now is for continuing this exemption.

12. **Khandsari.**—Accurate statistics regarding the production of Khandsari sugar are not available, but its average annual production during the recent years may be fairly assumed to be 75,000 tons. Khandsari is a wasteful process of producing sugar and the quality of the product is generally inferior. It is a relic of the past. Until lately there was a special demand for it among certain orthodox classes and in backward areas, but that has now almost entirely disappeared. There can be no place for it in any system of planned production. Special consideration was given in the past to Khandsari on the ground of its being a useful cottage industry. It is not a strong argument, however, as every grower has the easy alternative of converting his sugarcane into Gur. It is not desirable, therefore, to adopt any special measures to keep it alive. The excise duty on Khandsari is at persent -/8/- annas per cwt. as against Rs. 3/- per cwt. on sugar produced by vacuum pan factories. It would be desirable to increase it to the latter level as soon as vacuum pan factories are in a position to meet the demand of the country. The production will, however, even under the present conditions (provided price control is effective) continue to decrease and will by 1950 we believe not exceed say 50,000 tons.

13. **Expansion of existing units.**—Thus with the equipment now available and the improvements that can legitimately be expected, the annual production of sugar in India will, in 1950, amount to 13,00,000 tons. This leaves a gap of 3,00,000 tons. It is desirable, in the first instance, to improve efficiency and lower costs by the extension of uneconomical units. Factories with a crushing capacity of more than 250 tons and less than 800 tons daily should be encouraged to expand to the latter capacity, if there are reasonable prospects of the extra cane being found within an economic distance. Also all factories should be allowed to improve their efficiency by installing up to two sets of cane knives and up to 17 rollers, and enlarging their boiling house capacity to cope with the resultant increase in the crushing capacity. We are not recommending general extension to more than 800 tons capacity as that would serve to accentuate the already existing concentration of production in U.P. and Bihar, and we are similarly not recommending the extension of factories of less than 250 tons capacity as in their case the change would be not an extension but a complete substitution. If all factories make these changes, their production capacity will increase by 2,00,000 tons. It is likely, however, that many of them will, owing to the limitations of cane supplies or financial and other difficulties, be unable to expand. The annual increase in production on this account may be estimated at about 1,00,000 tons.

14. **Installation of new units.**—It is, therefore, necessary to instal new units with an annual production capacity of 2,00,000 tons. We

recommend that twenty new units with a daily crushing capacity of 800 to 1000 tons or an annual production capacity of 10,000 to 12,000 tons be installed as early as possible. The cost of producing sugar in units of a smaller size is likely to be too high to bear competitive conditions.

15. The improvements expected and the extensions contemplated above will give the industry, under average conditions, a normal production capacity of 16,00,000 tons, but its potential capacity will be higher and it will easily be able to produce an extra 1,50,000 to 2,00,000 tons if necessary to cope with a bumper cane crop. On the other hand production may be lower if the crop is poor in any year and sufficient sugarcane is not available to factories.

16. **The present concentration of sugar industry in U.P. & Bihar.**—A feature of the sugar industry is its concentration in the U.P. and Bihar. These provinces together have 103 of the 154 vacuum-pan factories in the country and normally account for 70 per cent. of the production. The following comparative figures regarding the area under sugar, the number of factories, and the production of sugar, in India and in certain provinces in 1931-32 and 1943-44 is of interest in this connection :—

	Area under cane (thousand acres)		Number of factories.		Sugar produced.	
	1931-32.	1943-44.	1931-32.	1943-44.	1931-32.	1943-44.
					(Tons)	(Tons)
United Provinces (Including Rampur) ...	1,593	2,192	14	70	73,000	727,100
Bihar & Orissa. ...	282	456	12	33	68,000	212,400
Punjab. ...	475	553	2	2	17,000	11,200
Bengal. ...	233	339	—	8		15,600
Madras. ...	117	148	2	12		39,200
Bombay, ...	99	169	2	10		81,200
N. W. F. P. ...	44	90	—	1		6,200
Rest of India. ...	—	—	—	18		—
TOTAL.	2,972	4,278	32	154	1,58,000	12,16,000

It has often been emphasised that sugarcane is a tropical plant and U. P. and Bihar being entirely in the sub-tropical region are not suited either for the production of sugarcane or the development of the sugar industry. The figures above however indicate that the concentration of the industry in this region is not purely fortuitous but is due to the recognition by both cultivators and manufacturers that the Gangetic Valley is a suitable area for this crop and this industry. The climate of peninsular India may be more suitable for sugarcane but the cost of production has usually been high, adequate irrigation facilities have not always been readily available torender possible the concentration of sugarcane area in suitable blocks sufficient to feed large factories and competition from other cash crops like groundnuts and tobacco has been severe. What is however surprising is the comparatively low recovery of factories in tropical India, except in Bombay and Deccan States.

The following figures are interesting :

		Recovery percentage.	
		1943-44.	1944-45
United Provinces	...	9·92	10·12
Bihar	...	10·53	10·7
Madras	...	9·31	9·15
Bombay	...	11·31	11·08
Hyderabad	...	9·88	9·0
Mysore	...	10·38	9·81

17. Need for Dispersal.—It is probable that on economic grounds alone there is room for further expansion of the industry in the submontane tracts of U. P. and Bihar but it is desirable that major industries should, as far as circumstances permit, be evenly distributed over the country and, therefore, we recommend that all new units should be installed in areas other than U. P. and Bihar. We understand that the Government of India has already given its approval to five new projects, one each in Travancore, Hyderabad, Baroda, N.W.F P. and Bihar. The first four of them are in areas deficit in sugar.

18. Selection of New Sites.—Sites, therefore, remain to be chosen for only 15 new units. We consider below the claims of individual areas for a share in them :

(1) *Madras* is climatically suitable for sugarcane cultivation, but the area under the crop is, at present too dispersed to provide many sites for new factories of the recommended size. There are at present twelve factories producing sugar directly from cane. Of these all but three have a crushing capacity of 300 tons or less. The primary effort should therefore, be to develop sugarcane in their areas to enable some of them to expand their capacity to 800 tons. For this reason only three new units should be allotted to this province.

(2) *Mysore.*—The one factory in this state has not been doing well recently. It produced 30,600 tons in 1939-40 and over 27,000 tons in each of the years 1940-41 and 1941-42. There has been since then a serious deterioration in its position, as the following figures would show :—

		Production in tons.	
1942-43	...	16,200	
1943-44	...	20,200	
1944-45	...	17,500	
1945-46	...	12,000	(Estimated).

There are however other suitable sites in this State and it is recommended that if the project already approved for Baroda does not materialise, that unit may be allotted to Mysore. It should be mentioned that Mysore is, even at present, a surplus area in respect of sugar.

(3) *Bombay and Deccan States.*—There is no site in this area where sugracane may be readily available for a new factory. There are however possibilities of development if adequate irrigation is made available.

The Provincial Government is at present owing to shortage of food-grains, restricting supply of water for irrigating sugarcane. A change in policy may however come about as soon as normal conditions return. Three new units may, therefore, be allotted to this area, one of which may be reserved for the Deccan States Group (including Kolhapur).

(4) *Punjab & Punjab States.*—Next to U. P. this is the second most important sugarcane area in India, but sugar factories situated there have not had a happy record. There were three factories in the Punjab in 1936. One of them has since shifted to the U. P. Another did not work in the last two seasons. There are two factories in the Kapurthala State, one of which has worked at a loss during the last three seasons. The probability, therefore, is that the Punjab is not a suitable area for sugar production—the recovery has been uniformly low; but there is some difference of opinion on this and we would provisionally allot three new units to this area, one being reserved for the Punjab States.

(5) *Assam.*—Conditions in this Province are favourable for a limited development of sugar industry, and we recommend the allotment of one new unit to it.

(6) *Bengal.*—We have considered the case of Bengal. There is scope for further development of the industry in this province in the long run, but the immediate problem is to create conditions, particularly in respect of cane supplies, that would enable the existing factories to produce to capacity. Bengal has nine sugar factories with a production capacity of 65,000 tons. They produced a maximum of 55,000 tons in 1940-41. Since then there has been a steady fall in their production and in 1944-45 they produced only 12,000 tons. It will, therefore, be unwise to allot any considerable capacity to Bengal until the production of the existing units is stabilised at a reasonable level, but we would provisionally allot three factories with 30,000 tons production capacity to Bengal on condition that the next two years indicate that the necessary steps to improve cane cultivation have been taken.

(7) *Orissa and Sind.*- Of the two remaining sugar factories it is proposed that one should be allotted to Orissa and one to Sind. With the improvement in irrigation facilities there is prospect of suitable cane areas being developed in these provinces, so as to justify the location of one sugar factory in each.

(8) *Other Areas.*—There are no suitable sites in other areas where sufficient sugarcane may be available in the immediate future for new sugar factories of the requisite size, except perhaps in the Indore State. This State has however already a sugar factory at a place where sufficient sugarcane is not available and it should be shifted to a better site.

19. Approval of new sites.—The choice of actual sites should be left to the local Governments concerned, but it would be useful to make the Central Government's approval obligatory. That Govt. would on account of its contact with conditions all over the country, be in a position to judge the comparative worth of each project.

20. Approval of the size and specification of new plants.—It is desirable that the Government of India should approve the size and the specifications of all new plants to be installed in the future and of extensions to existing plants in order to ensure that they are designed to secure maximum efficiency and to yield satisfactory results under competitive conditions. In operating the control over specifications great care will be necessary to see that there is no hampering of initiative – the sole aim should be to safeguard against unbalanced plants,

21. **Time-limit within which preliminary arrangements for new plants and for extensions must be completed : Re-allocation of factories not put up in time.**—As the need for expanding production is immediate the promoters of new projects should be allowed a period of not more than eighteen months within which to make all preliminary arrangements, financial and otherwise and to place final orders for machinery. If the provinces to whom additional units are allotted are not able to make these arrangements within two years, the lapsed capacity should be re-allocated as follows :

The first unit should go to Bombay ; the second unit should go to Gwalior, where it is understood a factory-building has already been erected ; thereafter factories not put up in the areas to which they have been allotted should be allocated to U.P. and Bihar, where the prospects of quick development are the most promising. In making allocations to these provinces first preference should be given to Gur Refineries provided they set up cane crushing plants in suitable sites. Similarly if the estimated increase of production by one lakh tons by way of the extensions mentioned in para. 13 does not come about, we shall be leaving the country's productive capacity short while waiting for extensions, and therefore a time limit is necessary in this case also. We suggest, in view of the present difficulty of finding machinery, a time limit of thirty months, when the position should be re-examined with a view to see whether any shortage in the estimated increase of production by way of extensions should be made up by fresh allocations for new plants.

22. **Shifting of Sugar Factories.**—It may be necessary in certain cases, when factories cannot get sufficient cane to meet their daily requirements or cannot run for an average number of days for want of cane, to split and shift part of factory to some other area. This will be permissible provided the aggregate crushing capacity of these split up units does not exceed the capacity of the original plant.

23. **Need for State Control.**—It is not necessary or desirable to place the industry under state ownership or management. Necessary private capital has readily been available in the past and will be so available for its extension in the future. A certain measure of state control over the production, prices and distribution of sugar is however necessary. Most important sugar producing countries, at some stage or other found it necessary to introduce central control over the sugar industry, primarily to deal with periodical overproduction and to stabilise the prices of sugar and sugarcane. The need for such central control is, in India, at least as much as anywhere else. The industry here has, even in its short career, suffered considerably from wide fluctuations from year to year in the area under sugarcane and the prices of sugar and sugarcane. When there is an abundance of sugarcane, prices are low and its disposal becomes difficult. This results in a reduction in the area under the crop, shortage of cane supplies in the following year and high prices of sugarcane which again, in due course, result in an increase in the area to a high level. Both the cane-growers and sugar factories suffer from this cycle. The former lose in years of low prices what they gain in others. They also suffer, in years of abundant supply, considerable inconvenience in the disposal of their produce. The latter are always uncertain of their possible production in any season and of getting a price for their sugar commensurate with its cost to them. On occasions, they were placed in a very awkward position owing to an unexpected surplus resulting in a sudden fall in the price. A serious aspect of such a situation is the feeling of nervousness amongst banks regarding the

safety of their advances to sugar factories, and the demands for their recovery have a further depressing effect on prices.

24. The need for planning production of sugar and sugarcane and stabilising the prices thereof is, therefore, urgent. An important factor, in this connection is the difficulty in estimating the yield of sugarcane, till late in the season, and this occasionally results in unexpected surpluses or deficits. Under planned distribution it should be possible to build reserves in surplus years and spread their disposal over lean years. Production could deliberately be curtailed for a time to cope with any unduly large accumulation of surplus stocks or these could be exported to neighbouring countries.

25. **Regulation of industry in U.P. and Bihar.**—There has already been an attempt to control the production and prices in respect ef sugar factories in U.P. and Bihar. In 1934 the Central Govt. passed a Sugarcane Act empowering Provincial Governments to fix a fair price for sugarcane. The only Governments which before the war fixed such a price, from time to time, were those of U.P. and Bihar. The United Provinces and Bihar Governments went one step further in 1938 and assumed more effective control over the industry through their Sugar Factories (Control) Acts. These included the following provisions:—

(1) the establishment of a Sugar Control Board;

(2) prohibition of the erection of new sugar factories or the extension of the existing ones without a licence;

(3) reservation of cane areas for factories;

(4) fixation of cane prices; and

(5) imposition of a cess on sugarcane.

The provisions of licensing included compulsory enrolment in the Indian Sugar Syndicate which was thus recognized by the United Provinces and Bihar Governments as the sole organisation for the selling of sugar produced in the two provinces. The licence also included a clause providing for a minimum wage for labour and fixed the quantity of sugar that should be manufactured by it during the period of the licence which covered one crushing season. Important amendments were made by the 1940 Amending Act, which constituted a Sugar Commission to be the final authority subject to Government Control, on all matters connected with the production, sale and prices of sugar. It also provided for the linking of the cane and sugar prices by providing for a deferred price for cane when the sugar price rose above the basic level. Another important amendment was made in 1943 prohibiting the cultivation of unsuitable varieties of sugarcane. The Indian Sugar Syndicate, mentioned above was formed in 1936-37 when sugar prices began to fall rapidly below the economic level and it helped to stabilise them Most of the factories outside U P. and Bihar did not join it, and soon after even its few members from other areas left it. Initially the Syndicate had a free hand in the marketing of sugar and the fixation of sugar prices. In 1940, however, when a serious crisis arose, owing to the difficulty in the disposal of sugar produced by U P. and Bihar factories particularly at prices justified by the cost of production, the two Provincial Governments had to extend control over the internal working of the Syndicate. It was thenceforth permitted to make sales only within the limits of prices and quotas fixed by the Provincial Governments. With the advent, however, in 1942 of Central Sugar Control, a war-time measure, the Sugar Controller for India took over all functions in respect of the prices and distribution of sugar.

26. Control to be exercised by Central Government. The experience in this country and elsewhere, the desirability of protecting the interests of consumers and harmonising them with those of cane growers and sugar factories, and the need for a machinery capable of prompt action in emergency render it necessary that there should be Central Government Control over all important matters relating to the industry, though the actual marketing may be left to an organisation of the industry it self, within the limits of Government instructions.

27. Matters to be subjected to Central Control.—The following matters should be subject to Central Government Control :—

(1) Location both of new factories and of existing factories when shifted to new sites.

(2) Sizes and specification of plants and additions to and alterations in existing units with the object of ensuring that the crushing capacity does not exceed the capacity sanctioned.

(3) Prices of sugarcane and sugar. A measure of Central Control on sugarcane prices is necessary as sugar prices depend mainly on them.

(4) Production of sugar, including allotment of production quotas to various regions and individual factories.

(5) Distribution of sugar. This will include allocation of sales quotas to individual producing areas and factories and also allocation of supplies from individual factories to various regions, with a view to avoid cross haulage and minimise the cost to consumers. In doing this the normal markets in pre-war days of factories should be taken into consideration.

(6) Fixation of carryover each year and its distribution amongst factories.

(7) Conditions of labour. This is necessary not only as the cost of labour is an important factor in the cost of production of sugar but also in conformity with the general national policy of giving a fair deal to labour.

(8) Exports including control over policy, quality, packing and prices.

(9) Production, quality and prices of special sugars and confectionery.

28. Need for collaboration with Local Governments.—The Central Government should exercise such control in close collaboration with local Governments and should, in particular, give them within the general frame-work of all-India policy, a free hand in respect of the locationof factories, additions to and alterations in them, intra-provincial distribution of sugar, steps to discourage cultivation of undesirable varieties of cane and conditions of labour. Formal Central control over these matters is desirable only to ensure a general uniformity of policy throughout the country, and to obviate the possibility of any action by Local Governments that might place the industry in any particular area or a section of it in a position in which it might become difficult for it to stand competitive conditions. If the cost of production of any group of factories is particularly high, presure might be brought on the Central Government to fix the price of sugar at a level necessary to accommodate them. Such a contingency should be avoided in the interests of the efficiency of the industry in general and those of the consumers in particular.

29. Existing local legislation to be abrogated.— All provincial legislation dealing with matters proposed to be brought under Central control will have to be abrogated and replaced by a Central Statute. Provinces will obtain delegated powers in respect of functions entrusted to them. All local cesses on cane should be abolished if they are incompatible with the all-India Control and Policy.

30. Executive authority.—The executive powers as regards Central control should be vested in an official Controller. He should have a representative Central Board to advise and assist him on matters of policy and a small technical committee to advise on problems relating to the extension of factories, replacement of machinery and generally on matters affecting the technical efficiency of the industry. The Central Advisory Board should consist of not more than seven representatives of the Governments of various regions, seven representatives of the industry, two of consumers, four of cane-growers, and two of labour: If at any time the Controller decided to turn down the advice of this Board he should state his reasons in writing. The Board should have the right of appeal to the Government of India against his decisions.

31. Marketing Organisation —The actual distribution of sugar should be by an organisation, the membership of which should be compulsory for all sugar factories.

32. Levy of a charge to cover obligations in respect of exports and storage. This marketing organisation or the Controller should levy a charge of one or two annas per maund for meeting any financial obligation in respect of exports and to compensate individual factories, if necessary for storing sugar surplus to the requirements of any particular year.

33. Need for Indian states having a common policy. It is desirable that the policy of the producing Indian States in respects of the production, prices and distribution of sugar be brought into line with the all-India policy in the matter and that they should participate in the operation of all-India Control on the same basis as British Indian provinces. We appreciate the constitutional difficulties involved but wish to express the hope that a reasonable solution of them would be found to ensure smooth working of sugar and other industries.

34. Protection to continue.- As there is little likelihood of the Indian Industry being able to compete with Java in the internal market during the next five years, it would be necessary to continue tariff protection to it during this period. The quantum of protection required will, however, depend on the comparative costs of production in the two countries when normal conditions return. It is yet too early to make any reliable estimates in this regard and the matter will, in due course, have to be considered by the Tariff Board. Meanwhile the existing duty should be extended.

35. Maintenance of Excise duty.—The quantum of the Excise Duty is directly related to the import duty. The existing import duty is at a level which enabled the local industry to compete with Java after the payment of Excise. It will be able to bear any Excise Duty as long as this relation between it and the import duty is maintained. The imposition of the excise duty, however, increases the cost of sugar to the consumer, which in a poor country like India results in curtailment of consumption. It is recommended accordingly that both the excise duty and the protective duty should be gradually reduced.

36. Reduction in the price of sugar desirable : measures required. —Efforts should be made steadily to reduce the cost of sugar. This is only sure way to lead to a greater consumption of sugar in the country. This could be achieved by—

(a) lower cost of growing cane;
(b) higher recovery from cane;
(c) lower excise duty;
(d) improved efficiency; and
(e) limiting of profit.

(a) and (b) are being considered by the Central Sugarcane Committee. From the excise duties levied on sugar, funds on a much bigger scale should be placed at the disposal of the Sugarcane Committee for studying these problems and taking steps towards the lowering of the cost of growing cane and increasing recovery. The Panel considers that in both these matters there is room for considerable improvement. Regarding the raising of the efficiency of the sugar factories, boiler furnace designs and consumption of steam in factories should be definitely improved so that the fuel consumption could be reduced appreciably. There is considerable scope for improvement both in the chemical and engineering sections of the sugar factories. Competent chemists and engineers should regularly inspect each factory, thoroughly examine its workings and advise on the ways and means by which economy could be effected. Individual factories may not, however, be able to afford sufficiently competent help and this may not always be available to them locally. It is recommended that the supervising and inspecting chemists and engineers should be attached to a Central Organisation such as the Imperial Institute of Sugar Technology. The total revenue from sugar excise duty is likely to be increased on account of the increased consumption of white sugar as recommended by the Panel. The Panel suggests that a downward spiral of lowering prices should be created by the lowering of the excise duty by the Government. Sugar prices should be so fixed that the margin of profit should be reasonably low. The sugar industry is no longer a pioneering industry and the elements of uncertainty and risk are not great now. Hence a lower margin of profit is justifiable. Also, with higher outturn it should be possible to reduce the margin between the production and selling prices of sugar.

37. **Need for intensification of agricultural and technological research.**—The industry does not need any bounties as it is receiving and will presumably continue to receive the necessary protection through the tariff policy. It does not require any special expert advice from abroad, except for fabrication of machinery. A competent advisory service should, however, be organised to inspect factories and to help them in improving their technical efficiency, whether by remodelling of their machinery or by improving manufacturing processes. The existing Institute of Sugar Technology is not sufficiently well-equipped for the purpose and its staff and equipment should be augmented to meet the requirements of the industry. Research both agricultural and technological should be intensified, with particular reference to the varying conditions in the different parts of the country. The Central Government, at present, gives a grant of -/1/- anna per cwt. from the Excise Duty to the Indian Sugar-cane Committee for the purpose. This is inadequate and should be increased to -/4/- annas per cwt.

38. **Utilisation of by-products.**—The production of power alcohol and food yeast from molasses, which is the most important by-product of the sugar industry, will be discussed later. Steps should also be taken by the organisation of research and application to make proper use of

press mud and bagasse. Bagasse is at present mainly burnt as a fuel in the sugar factories. Many factories consume coal or wood fuel in addition to bagasse. With improvement in technical efficiency it should be possible for factories not only to dispense with all extra fuels but also to save bagasse for other purposes. Bagasse has been found useful for the manufacture of insulating and pressboard, wrapping paper and straw-board. It has been used for the manufacture of plastics and resins. Glass, suitable for making coloured bottles, has also been prepared from bagasse ash. Press mud could be used for the preparation of fertiliser, wax, activated carbon, dye-stuff and distemper. The above uses for bagasse and press mud require further investigation.

39. **Comparative duty on finished Machinery & Raw Materials for Manufacture of Machines.**—The Panel is of opinion that the duty on component parts or raw materials from which machinery is made should in no circumstances be higher than duty on finished machinery.

40. **Need for intensifying cane development with particular reference to certain aspects.**—The greatest scope for improvement in the efficiency of the industry, with a view to reduce the cost of production of sugar, is by improving the quality and yields of sugarcane. The cost of sugarcane is the most important item in the cost of sugar. Therefore, while it is recognised that various other considerations might contribute to the statutory determination of the price at which cane may be sold to factories, it is essential that it should be produced cheaper than at present and should yield a higher recovery of sugar. Considerable work has, in this regard, been done, during the last ten years, by the Central and Provincial research stations and the local departments responsible for the development of sugarcane in the field. Reliable statistics regarding improvement in the yields of sugarcane are not available, but there is no doubt that these have in recent years increased, particularly in the factory areas in U. P and Bihar. Improvement in recovery is more clearly noticeable as the following figures show :—

सत्यमेव जयते

Year.	Recovery percentage.		
	U. P.	Bihar.	India.
1931-32	8·59	9·06	8·89
1944-45	10·19	10·69	10·2

Nevertheless the success achieved has been much below expectations. There is considerable scope everywhere, and particularly in areas like Bengal, further to improve the yields and quality of sugarcane, and it is an urgent necessity that the Central Government, through the Indian Sugarcane Commitee and the Local Governments in collaboration with it and through their departments of agriculture and cane development, should force the pace of improvement by all possible means, special stress being laid on the specific problems of individual areas. Steps should concurrently be taken to augment supplies of sugarcane at factory gates, by improving means of communication, and to regulate supplies in a manner that would ensure the maximum actual recovery of sucrose available in cane. The following items should have a special place in development programmes :—

(1) Propagation and introduction of new varieties giving higher yields per acre and a better recovery of sugar, with particular stress on early and late ripening varieties. Conditions in each producing area should be separately studied with a view to evolve varieties suitable for them.

(2) The practice of ratooning should be more carefully examined so that cane-growers and factories should be able to secure maximum results in yield and recovery.

(3) Research should be made to improve the existing manurial practices and arrangements should be made for the adequate supply of fertilisers.

(4) Provision of adequate irrigation facilities and improvement in irrigation practices.

(5) Research with a view to devise improved agricultural implements to suit local conditions.

(6) General improvement in methods of cultivation, including rotational practices.

(7) Devising practical methods of controlling insect pests and diseases.

(8) Provision of an adequate field organisation in every producing area to give general guidance to growers in matters relating to cane cultivation, to enable the quick application by cultivators of the results of research, to ensure timely control over insect pests and diseases, and to arrange for the adequate and timely supply of seed, implements and fertilisers. A chain of suitably located model farms run by the Government, sugar factories or co-operative societies, as may suit local conditions, should form an integral part of the scheme.

(9) Improvement of communication in factory areas by construction of a net-work of roads and assistance to factories in putting up tramways and obtaining diesel lorries, preferably with trailers.

(10) Regulation of sugarcane supplies to factories in a manner that would ensure supply to them, throughout the crushing season, of fresh and properly matured cane.

41. **Increase in yields & recovery expected.**—It should, by action on the lines indicated above, be possible to increase the yield of sugarcane generally by at least 25 per cent, in the next five years and the recovery of sugar from sugarcane by one per cent.

42 **Confectionery and special sugars.**—The manufacture of confectionery of good quality and special sugars such as sugar cubes, Demerara sugar, Icing sugar and fruit products like jams and squashes should be encouraged. The Tariff Policy in respect of manufactured goods of which sugar is an important ingredient should be revised by increasing the import duty on them to a level that would place the sugar imported in indirect forms at par with ordinary imported sugar.

43. **Requirements of capital goods**—The expansion of the Sugar Industry required for reaching the target production of 16,00,000 tons of sugar annually may be secured by (1) fuller exploitation of the existing capacities of sugar factories, (2) enlargement of existing small plants to a capacity of about 800 tons cane per day and (3) construction of about 20 new factories of 1000 tons cane per day capacity. For securing such expansion, a fairly large quantity of sugar machinery will be

needed, The proposed 20 new factories will require approximately 40,000 tons of machinery, valued roughly at £4 millions or 5·3 crores of rupees F.O.B. port of shipment. Almost an equal quantity of machinery will be needed for the proposed extensions to existing factories. A large amount of machinery and machinery parts will also be required for effecting renewals and replacements in existing factories, which have fallen heavily in arrears during the recent war years.

The total cost of all the machinery required for the purposes stated above, including insurance, import duty and sea freight to Indian ports, is therefore likely to be about £9 millions or 11 to 12 crores of rupees. Detailed lists of machinery required have been drawn by the Imperial Institute of Sugar Technology (see Appendix XIV) and the estimated cost has been based on the average present prices in important sugar machinery manufacturing countries abroad.

At the same time detailed enquiries have been made by the Institute to ascertain the possibilities for the fabrication of sugar machinery by engineering firms in India. It has been found that there are several such firms possessing equipment suitable for this type of work who would presumably gladly take it up now that the pressure of work in connection with the war is reduced. The items of machinery likely to present some difficulty, at least in the initial stages, are electrical goods, engines, boilers and some of the material required for the fabrication of this machinery, such as special steels, brass and copper tubes, Calandria plates, copper liners, etc., which are not made in India yet.

In the opinion of the Panel, there is little doubt that a substantial, if not the greater, part of the machinery required for sugar manufacture can be made within India.

There are *prima facie* grounds for holding that the cost of manufacturing sugar machinery in India will be lower than that of importing such machinery from abroad ; at any rate, this is likely to be the position at least during the next few years, in the course of which it is unlikly that the high level of prices now demanded by foreign manufacturers of machinery will come down. But even if, contrary to present expectations, the cost of making sugar machinery in India should turn out to be somewhat higher than the cost of importing such machinery, there will still, in the opinion of the Panel, be sufficient compensatory advantages in manufacturing the machinery in this country, which will more than offset the higher prices, assuming that the prices will be higher. For one thing, and quite apart from the obvious advantage to the engineering industry of the country, it is clear that the setting up of an industry for the manufacture of sugar machinery will facilitate replacements and repairs of such machinery and reduce the cost thereof in the long run. For another, in view of the urgent need for increasing the production of sugar and the uncertainty in respect of deliveries of machinery from abroad in the next few years, it would appear that India should rely, as far as possible, on manufacturing its own machinery. The Panel accordingly recommends that a central expert organisation attached possibly to the office of Sugar Controller or the Imperial Institute of Sugar Technology, Cawnpore, should be set up for ascertaining requirements, for classifying and consolidating them, for the programming of their supply, for the preparation and supply of design, and for organising contacts between factory owners and engineering workshops. When this organization has been set up, priority and other assistance for the import of sugar machinery should be given only in respect of establishment of plants such as power plants, power units, etc., which cannot be manufactured in India without difficulty.

POWER ALCOHOL.*

44. It is desirable to develop the power alcohol industry in India with the objects primarily :

(a) of establishing an alternative source of motor fuel partially to replace petrol, the indigenous supply of which in the country is short, and

(b) of utilising the surplus of molasses which is wasted at present.

45. In all progressive countries, where indigenous petrol is not available in sufficient quantities, it has been considered desirable to develop alcohol as a motor fuel. Great Britain, France Germany, Poland, Czechoslovakia, Italy,and Australia have all been producing power alcohol from indigenous sources such as beet, potatoes and corn ; and, to a certain extent, from imported molasses. The cost of alcohol in most of these countries is much greater than that of imported petrol. The production and use of alcohol as a motor fuel has, nevertheless, been encouraged and State aid given generously by means of rebates, bounties and by special regulations.

46. Of all raw materials from which alcohol can be produced on a large scale, molasses is known to be the most suitable. Brazil, which grows sugarcane in abundance, and produces a large quantity of molasses as a by-product in the sugar factories, has developed a flourishing alcohol industry. The production of alcohol has increased steadily in recent years and in 1941-42, which is the latest year for which figures are available, nearly 29 million gallons of alcohol were produced in Brazil. Of this quantity about 19 million gallons were obtained from molasses, 8 million gallons from cane juice and 2 million gallons from re-dissolved sugar.

47. Although India is now one of the biggest sugar producing countries in the world, no systematic attempt has so far been made here to develop the power alcohol industry. At present, there are only five distilleries in India capable of producing power alcohol Of these, two are in the United Provinces, one each in Bombay Province, Hyderabad and Mysore. The combined maximum capacity of the three distilleries in British India is about 'one and a half million gallons annually. The two distilleries in Hyderabad and Mysore are capable of producing about 500,000 gallons each per annum. When they are in full operation, the five distilleries are thus capable of manufacturing about two and a half million gallons of power alcohol. Their total production, so far has not, however, exceeded one million gallons a year.

48. Nearly 400,000 tons of molasses are produced annually in India as a by-product of the sugar industry. About 150,000 tons of molasses are utilised ordinarily for the manufacture of rectified spirit, potable alcohol, methylated spirit and the curing of tobacco etc. Approximately 250,000 tons of molasses ar thus left over annually, for which no satisfactory use has been found. Part of this is burnt as fuel ; a small portion used as manure in the field ; and the greater portion is thrown away as waste, fouling the water-courses and the countryside.

49. The estimated pre-war consumption of petrol in India is 100 million gallons. Of this only about 17 million gallons were produced in the country ; the rest was imported, about 74 million gallons from Burma and about 10 million gallons from other countries. Thus India has been dependent on other countries for over 80% of her requirements of petrol. The production of power alcohol would increase our resources of motor fuel and would be important for strategic reasons or on occasions of exchange difficulty such as at present.

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* The term "power alcohol" as used in this report denotes anhydrous alcohol of at least 99·5% strength by volume. The term "rectified spirit" is used to denote alcohol of 94.0% strength by volume and above (Grade I strength 96% alcohol and over ; Grade II strength 94%—96% alcohol).

50. At the present moment on account of the scarcity of motor fuel, a number of motor vehicles have been fitted with producer gas plants. The use of producer gas has not been an unqualified success in this country and it is believed that in future not many motor vehicles would continue to run on producer gas. Also, it is believed that motor vehicles run on diesel oil will not be so numerous as to effect appreciably the consumption of petrol. With the increase of inter-provincial trade and the construction of new roads the demand for low flash point liquid motor fuel is expected to increase appreciably and it is estimated that in the very near future this requirement would reach 120 million gallons per year.

51. The Panel has recommended that the production of sugar in the country should be increased to 16,00,000 tons per year within the next five years. The surplus molasses available from this quantity of sugar will be adequate for the manufacture of 20 million gallons of power alcohol per annum which should be taken as our target of production to be reached within the next five years.

52. **Manufacture of power alcohol recommended by Government Committees, chambers of commerce and bodies representative of the sugar industry.**—The problem of the manufacture of power alcohol has been examined several times in recent years by various Committees appointed by Government. In 1938 the Indian Tariff Board of Sugar Industry examined the question of utilisation of surplus molasses and the production of power alcohol. The Board definitely recommended the starting of power alcohol production on an all-India basis and commented very favourably on the prospects of the venture. The report stated that "the industry and the Provincial Governments are united in the view that the manufacture of power alcohol is from the economic point of view the only profitable outlet for molasses in present conditions ;" and also that "the establishment of so important a by-industry can be commended as a step in the direction of India's industrialisation and as an outlet for Indian capital and the means of remedying the unemployment problem".

53. A Joint power Alcohol and Molasses Inquiry Committee consisting of well-known scientists and industrialists was appointed by the Governments of the United Provinces and Bihar in 1938. After a detailed and careful examination of the question, the Committee observed that the conditions in the United Provinces and Bihar (with which it was specially concerned) were very favourable for the manufacture of power alcohol.

54. More recently, at a conference convened by the Deptt. of Planning and Development in November 1944, the question of the establishment of the power alcohol industry in India was discussed by the representatives of the Central and the Provincial Govts. and the Indian States. The views expressed at the Conference were definitely in favour of large-scale production of power alcohol.

55. The Chambers of Commerce in the country and the Bodies representing the Sugar Industry have supported proposals for the establishment of power alcohol industry and on several occasions have expressed their disappointment that the proposal has not been implemented more fully and with greater vigour.

56. Most suitable mixture of alcohol and petrol for use as standard motor fuel.—While in certain parts of the country, where large distilleries for the manufacture of rectified spirit are already in existence, unmixed rectified spirit could be used with advantage for stationary engines, agricultural tractors and certain commercial motor vehicles, it seems desirable that a uniform mixture of power alcohol and petrol should be adopted throughout the country as a standard fuel for internal combustion engines. The panel considers that a mixture of 20% power alcohol and 80% petrol is the most suitable for this purpose. (For a discussion of the technical aspects of the use of alcohol as a motor fuel see Appendix XXI). The mixture is in many respects superior in performance to neat petrol. It has an octane value higher than that of petrol and consequently better anti-knock properties; it is more volatile and the engine can be started in the cold more easily; it has a higher latent heat and can bear higher compression; the power output of the mixture is for all practical purposes the same as that of petrol; it deposits less carbon in the combustion chamber of the engine; and it does not have any more corrosive effect than straight petrol.

57. The mixture of 20 per cent alcohol and 80 per cent petrol could be used in motor vehicles inter-changeably with petrol without any alteration in the carburettor and engine settings. This is an important point in the early stages of the development of the power alcohol industry, as power alcohol for admixture with petrol may not be available everywhere, and a motorist moving from one district to the other may be required to use either the mixture or ordinary petrol, according to what is available. The percentage of power alcohol in the mixture with petrol could be made to vary from 20% down to nil without appreciably changing the properties of the fuel. This permits of considerable flexibility in planning the distribution, particularly in the early stages, when power alcohol may not be available everywhere in required quantities. Alcohol is absolutely essential for certain industries, while it is not absolutely essential for motor transport that alcohol should be mixed with straight petrol in any definite proportion. The off-take of power alcohol for transport purposes can therefore be adjusted to suit the quantity of power alcohol available for this purpose.

58. Cost of power alcohol. The Joint Power Alcohol and Molasses Inquiry Committee of United Provinces and Bihar (1938) carefully examined the question of the cost of production of alcohol. According to their findings, power alcohol could be produced at a cost of 6 to 7 annas per gallon. More recent estimates are also available. According to an estimate prepared by the Aluminium Plant & Vessel Co., Ltd., the cost of production works out as follows:—

(See Appendix XVI).

TABLE I.

Price of molasses at 4 annas per maund.

Average number of working days 300 per annum.

Cost of production of power alcohol in plant producing 2,200 gallons per day or 660,000 gallons per annum.	7.4 annas per gallon.
Cost of production of power alcohol in plant producing 4,400 gallons per day or 1,320,000 gallons per annum.	5.9 annas per gallon.
Cost of production of power alcohol in plant producing 6,600 gallons per day or 1,980,000 gallons per annum.	5.2 annas per gallon.

These figures are based on the cost of materials as in September 1942.

59. Details of the cost of erection of a distillery of production capacity 3,300 gallons power alcohol per day, based on the present cost of materials has been worked out by a Sub-committee of the Panel and is shown in Appendix XVII. As the prices of most of the materials required for construction are controlled, the cost of erection of a plant in 1945-46 will not be appreciably different from that in September 1942. Making allowance for the present enhanced prices of fuel, chemicals, etc., we arrive at the following revised estimate of the cost of production of power alcohol :--

TABLE II

In a 2200 gallon/day plant ...	... 8.0 annas per gallon.
In a 3300 gallon/day plant ...	... 7.2 annas per gallon.
In a 4400 gallon/day plant ...	... 6.5 annas per gallon.
In a 6600 gallon/day plant ...	... 5.8 annas per gallon.

60. If the price of molasses is reckoned at 6 annas a maund instead of 4 annas as in the above estimates the production cost will be as follows :—

In a 2200 gallon/day plant ...	... 8.8 annas per gallon.
In a 3300 gallon/day plant ...	... 8.0 annas per gallon.
In a 4400 gallon/day plant ...	... 7.3 annas per gallon.
In a 6600 gallon/day plant ...	... 6.6 annas per gallon.

61. **Comparison of Prices of Power Alcohol and Petrol.**—The selling price of Petrol ex-Pump at a port is arrived at by adding to the calculated price of petrol at the port the Government duty of 15 annas per gallon, clearance and storage charges, distributor's charges, the agent's commission, etc. For the selling price ex-pump at up-country places, the cost of transport from the nearest main port is added. It has not been possible to obtain an accurate figure of the cost of production of petrol in this country, or the landed cost of imported petrol. According to the system of calculation adopted by the oil companies, the price of petrol at present may be taken as 6½ annas per gallon at the port of Bombay. The price is about the same at Madras and Karachi. With the return of normal conditions, the price of petrol, however, might become less.

62. The cost of production of power alcohol in standard distilleries of capacity 3300 gallons per day or about one million gallons per year of 300 working days, which is the size recommended by the Panel, will be about 7 to 8 annas per gallon varying with the price of molasses from 4 to 6 annas per maund. The production cost in larger size distilleries, some of which it may be feasible to put up in special areas, will be lower.

63. Though it should be our aim to manufacture all power alcohol in modern distilleries of one million gallons/year capacity or above, it may not be feasible to do so in the beginning. The question of the distilleries which have been producing rectified spirit in order to meet the large demand of the Defence Services and other essential requirements will have to be considered carefully. Some of these are so antiquated and badly designed that it will not be economical to refurbish them. In the case of others, however, an attempt should be made to convert them into power alcohol distilleries by the addition of necessary dehydrating columns. The production cost of power alcohol from these distilleries will be comparatively high. The same is to a certain extent true in the case of smaller distilleries of modern designs, some of which it may be necessary to instal in areas where the supply of molasses is not abundant.

64. In the United Provinces and Bihar where molases is readily available, and where the first new modern distilleries should be located, it may be possible to make power alcohol available at a price lower than petrol, which has to be carried in tank wagons from the main ports. For other areas specially those in and about the port towns, the price of alcohol would be higher. It would, however, be possible to cut down considerably the cost of transport of power alcohol from the distilleries to the ports by utilising for its transport the empty tank wagons returning to the ports after discharge of petrol in up-country areas.

65. On the whole, it seems reasonable to expect that the difference in cost between power alcohol and petrol will not be so great as to affect appreciably the price of the alcohol/petrol mixture. The mixed fuel will contain only 20% power alcohol, and even in most unfavourable circumstances, when the cost of power alcohol is appreciably higher than that of petrol, the selling price of the mixture to consumers will not be more than 1½ to 2 annas per gallon higher than that of unmixed petrol. To a certain extent the extra cost will be justified as the power alcohol/petrol mixture will be a better motor fuel.

66. It may be stated that hardly anywhere in the world has power alcohol been produced at a price competing with that of petrol. In European countries in pre-war years, power alcohol was heavily subsidised. A summary of the Report of the Power Alcohol Committee of Inquiry of Australia, 1941, may be seen in Appendix XXII. It will be seen therefrom that although the calculated cost of production of power alcohol was considerably higher than that of petrol, the Committee strongly recommended the production of power alcohol and advocated its use in place of imported petrol. The conditions in India, as in Brazil where a considerable power alcohol industry has been developed in recent years, are much more favourable than in England. Czechoslovakia, Germany or Australia, as a comparatively larger quantity of molasses is available in this country, much of which is wasted at present and can therefore be had at a low price. Although the cost of power alcohol in India might be somewhat higher than that of petrol,the difference is likely to be much less than in Australia or in the European countries mentioned above.

67. **Excise duty on Power Alcohol.**—The Government of India have so far opposed all proposals for preferential treatment of power alcohol used as motor fuel in respect of exemption from excise duties. As pointed out above, the price of power alcohol might be higher than that of petrol. The consequent increase in the price of alcohol/petrol mixture, as compared with that of unmixed petrol will have to be borne either by the consumers or by the State. The Panel considers that in view of the strategic importance of the development of the power alcohol industry the latter alternative would be more desirable, and therefore recommends that the excise duty on power alcohol should be less than that on petrol.

68. **Production of Power Alcohol** The standard size of distilleries should be one million gallons capacity, but a smaller size of half a million gallons capacity may be allowed in special areas having a smaller output of molasses. Units larger than one million gallons capacity may also be permitted in certain cases.

69. Sugar factories should be divided into groups, each capable of meeting the molasses requirements of one distillery. Each distillery may be owned jointly by factories supplying the mollasses, the share of each sugar factory in the distillery being in proportion to its capacity for supplying molasses.

70. While the sugar factories might be given an option to join as share holders of the distillery, the selling of molasses to the distillery in proportion to the crushing capacities of the factories shou'd be made compulsory. The actual quantity of molasses requisitioned would depend on the size of the distillery.

71. Licensing of Distilleries.—It is proposed that all distilleries should be licensed. A definite policy should be laid down for licensing and the following points should be kept in view in sanctioning a license:—

(a) Availability of molasses;

(b) Cost of transport of molasses from the sugar factories to the distillery; and

(c) Cost of transport of alcohol from the distillery to mixing depots.

72. Each sugar factory should have covered storage capacity for about 75% of its molasses production and the distilleries should have arrangements for the storage of at least 50% of their annual requirements of molasses.

73. Location of distilleries.—A list of the principle distilleries in existence at present is given in Appendix XV. Those that are properly situated in respect of their supply of molasses should be given an opportunity to expand to the prescribed limit. If they are unable to make the necessary extensions, they should be replaced by new units. In the past some distilleries have been wrongly located. The cost of transport of molasses to these will be permanently higher. It may be worthwhile shifting these distilleries to more suitable places and the Government might meet a part of the cost of removal in such cases.

74. The standard distilleries should be situated mostly in the United Provinces and Bihar which are the main sugar producing areas. Suggestions about the proposed locations of 11 distilleries in the U.P., 4 in Bihar, 2 in Bombay, 2 in Madras and Orissa and 1 in Bengal for the production of power alcohol, and about the grouping of sugar factories for supply of molasses to them are indicated in Appendix XIX.

75. Mixing.—The mixing of power alcohol with petrol should be compulsory in such proportion as might be prescribed and in such areas as are notified from time to time. The mixing should be done in the petrol storage depots at present run by the different oil companies, the sites of which are shown in Appendix XX.

76. Areas supplied by power alcohol/petrol mixture.—In the interest of economy in transportation it is obviously desirable at first to put power alcohol in use in areas around the centres of production. The use of power alcohol/petrol mixture in such areas should be compulsory. In the event of short supply of power alcohol, the area supplied with the alcohol/petrol mixture should be cut down, maintaining the same percentage of alcohol in the mixture. Beginning should be made with the U.P. and Bihar and areas around them where power alcohol would be easily available in required quantities. Other areas should continue to use neat petrol till such time as the mixture becomes available. The total area supplied by the alcohol/petrol mixture should progressively expand with increasing production of alcohol.

77. Control of power alcohol and molasses : appointment of Alcohol Commissioner.—Power alcohol should be produced in distilleries owned and managed by Sugar factories, but the control over its production, distribution and price should be vested with the Central Government. An Alcohol Commissioner should be appointed to exercise this control on behalf of the Central Government.

78. The Alcohol Commissioner will (a) be the licensing authority for all distilleries producing power alcohol ; (b) supervise the industry and ensure that the standards of production are maintained ; (c) deal with disputes and difficulties in connection with the industry ; (d) direct the future development of the industry so as to be in line with the sugar industry ; and (e) fix the price of power alcohol. The Sugar Controller might with advantage be appointed as the Alcohol Commissioner in addition. He should be assisted by a Committee having the same powers as in the case of Sugar.

79. It is essential that there should be strict control by the Central Government over the movement and price of molasses so as to ensure its availability to the distilleries. There should also be adequate safeguards to maintain the quality of molasses. The price of molasses should be based on the total fermentable sugar present expressed as hexose. There should be price deduction or other penalties for dirty molasses or the presence of harmful substances such as SO_2, as these cause considerable difficulties to the distiller.

80. Molasses is required for tobacco curing, potable spirits, and other industrial purposes besides the manufacture of power alcohol It should be arranged with the sugar factories as to what proportion of their molasses should be sold for purposes other than the manufacture of power alcohol in different regions. This should be limited to 25% of the total production of molasses. The Alcohol Commissioner should be entrusted with the responsibility for control of molasses. Any particular Provincial Government in consulatation with the Controller, may make arrangement to modify this limit of 25%.

81. **Expert adviser.**—The Panel does not consider the appointment of a firm or firms as consultants as necessary, but thinks it to be desirable that an expert should be attached to the Alcohol Commissioner to help and advise the industry on the fabrication of plants and the production of alcohol.

82. **Transport of molasses and power alcohol : necessity for the reduction or railway freights**.—With the establishment of a number of large distilleries the traffic in alcohol and molasses would increase very considerably and it is necessary that there should be adequate number of railway tank wagons available for their transport. The Panel understands that there will not be much difficulty regarding the availability of tank wagons when the present abnormal demands on the railways cease and new wagons become available.

83. As already stated, the production of power alcohol will be confined mostly to the United Provinces and Bihar. Alcohol will therefore have to be transported to the mixing depots in different parts of the country. The Panel feels that in order to reduce the selling price of power alcohol which would make its use feasible, it is essential to keep the freight charges as low as possible. Tank wagons returning empty at present, after conveyance of petrol from ports to the up-country towns, may be used to take back power alcohol to the port towns. The Railways should find it possible to fix lower rates for the conveyance of power alcohol in the tank wagons which would otherwise return empty.

84. In the opinion of the Panel the distilleries proposed to be put up for the production of power alcohol would probably get one-third of their requirements of molasses on the spot and two-thirds from areas

varying from 5 to 40 miles distant In order that the distilleries may operate as economic units, it is essential that molasses should be available to them at a very cheap price.

The cost of molasses at the distilleries would depend to a great extent on the cost of railway transport from the sugar factories. It is, thus, important that the Railways should charge the lowest rates possible. To enable the Railways to quote lower transport rates for molasses, it is desirable that the tank wagons carrying molasses should be kept busy all the year round and should not be required only for a few months in the year. The Panel is also of the opinion that the freight charges for the carriage of molasses from places between 5 to 40 miles should be the same, so that the price paid for molasses at all distilleries may be uniform The Railway Board has already been requested by the Panel to consider the points mentioned above.

85. Sales organisation for power alcohol.—The distribution and sale of power alcohol should, it is suggested, be carried out for the present by the existing oil companies. In the event of their unwillingness to do so, a new organisation would have to be set up under control of the Central Government.

86. A method of marketing power alcohol on an all-India basis at a uniform price is given below :—

(a) A schedule of prices should be drawn up for molasses depending on its content of fermentable sugar and its purity. Molasses should be purchased by the distiller direct from the sugar factory and the scheduled price paid for it. This price should be for molasses loaded into the tank wagons by the factory.

(b) The distiller should be responsible for unloading the tank wagons

(c) Power alcohol should similarly be purchased direct from the distiller (free on transport) by the oil companies who would be responsible for unloading.

(d) The cost of transport (mostly by rail) would be collected direct from the oil companies by the Railways, etc. on the basis of the number of gallons supplied to each company irrespective of the distances involved. This cost is to be worked out on the total transport charges of alcohol.

(e) The cost of transport would be estimated in advance by the Alcohol Commissioner for any convenient period (say quarterly) and the sale price of the mixed product for that period fixed accordingly. Any miscalculation for one period would be corrected by altering the sum to be paid in the next.

(f) The charge per gallon of mixed motor fuel to the public will be made up as follows :—

(i) Cost of oil Co.'s petrol ...	4/5 gallon.
(ii) Cost of power alcohol ...	1/5 „
(iii) Cost of transport of alcohol to the mixing depot ...	1/5 gallon.
(iv) Cost of transport of petrol to the mixing depot ...	4/5 „
(v) Oil Co.'s charges for distributing. mixing etc. ...	per 1 gallon of mixture.
(vi) Central Government Tax ...	per 1 gallon of mixture.

87. At present the tax on the motor spirit is collected from the consumer through the oil companies. The price paid by the consumer at the pump includes this tax, and the oil companies act as tax collectors. In the scheme detailed above the oil companies would also act as freight collectors.

88. As the oil companies would be required to pay a sum depending on the total sales of the alcohol blend, the amount of extra book-keeping required would be reduced to a minimum.

89. Since the distiller gets his raw material at a fixed price and the price of the product is also fixed, he would be able to secure the benefit of any increase in efficiency that he can introduce in his own organisation.

90. The distiller would be expected to produce a minimum quantity of alcohol from a given amount of raw material. A certain margin below the standard yield would be permitted, but deficiencies below this would be regarded as loss and steps would be taken to prevent the use of "power alcohol molasses" for unwarranted purposes.

91. Addition of denaturant.—The addition of a denaturant appreciably increases the cost of power alcohol. Moreover, power alcohol, when available to the public, will be mixed with petrol and will be non-potable. The possibility of eliminating the need of a denaturant has therefore been considered carefully. It is agreed, however, that this will not be feasible. Undenatured power alcohol would, from the excise point of view, be classed as "high strength rectified spirit" on which a duty at the high rate applicable to Indian-made foreign liquor (roughly Rs. 40/- per L. P. gallon) is normally charged. Any leakage in transit would, therefore, constitute a direct threat to the revenues of a province.

92. It is considered that the most suitable denaturant for power alcohol would be petrol. Admixture of 5 per cent petrol with power alcohol should be made at the distilleries before it is sent out for transport to the mixing depots. The distilleries should store adequate amount of petrol for this purpose. The cost of actual mixing in the denaturing vats will be very small. At the mixing depots corresponding deduction in the admixture of petrol should be made.

93. Subsidiary Industries. - Attention should be paid to the development of manufacture of solvents such as butyl alcohol and amyl alcohol ; and for the production from ethyl alcohol, of such chemicals as acetic acid, acetaldehyde, ethyl acetate, ether, chloroform, etc.

94. Efforts should also be made to utilise the spent effluent from the distilleries for the recovery of potash and other materials ; and for the manufacture of "dry ice" from carbon dioxide, which is produced in the process of manufacture of alcohol.

95. Uneconomical distilleries in India.—Many of the distilleries in India are old, a few dating back to 1880. The concentration of wash is usually too low and the utilisation is imperfect ; proper biological control of yeast is mostly neglected ; heat exchangers are not usually provided and the exhaust steam is not utilised ; and lastly the fuel consumption is higher than in properly designed modern distilleries. Some of the distilleries will have to be scrapped and many will need complete rehabilitation. A careful survey of the plants should be carried out and a target of efficiency set.

96. Fabrication of Distilleries.—The Panel is of opinion that distillery plants can and should be fabricated in this country. Patent rights should be acquired, where necessary, by the Central Government from the foreign manufacturers. Licenses for the manufacture of plants should be given only to approved parties, who should receive all necessary assistance from the licensing authorities in receiving raw materials for manufacture at a reasonable cost.

97. It is claimed that foreign plants of the latest design are more efficient both as regards recovery of alcohol and consumption of steam. This claim is not fully admitted by those in charge of distilleries designed and fabricated in India Some of the distilleries fabricated in this country are working satisfactorily. The fuel consumption is rather high but this is due to factors which can be rectified. If, however, foreign manufacturers are prepared to guarantee appreciable increase in efficiency and lower steam consumption or the Indian fabricators are unable to undertake the manufacture and supply, licenses may be given for the import of a few plants. In the meantime, patents rights should be acquired for exploitation in the country.

98 Details of the cost of erection of new distilleries in India are shown in Appendix XVII. It will be seen that the cost of a modern distillery of one million gallons capacity will be about rupees 9 lakhs, of which amount between 25 to 30 per cent will have to be spent on imported units of plant.

99. Number of New Distilleries Required and Cost of Erection. — Calculating on the basis of yield of molasses at 30 per cent of the quantity of sugar produced, the annual production of molasses will be 4,80,000 tons when the target production of sugar of 16,00,000 tons per year is reached. It is believed that market will be found for about 50,000 tons of molasses annually for purposes other than the production of alcohol. The balance of 4,30,000 tons would suffice for the manufacture of about 26 million gallons of alcohol annually, of which 20 million gallons would be power alcohol.

100. There are a number of existing distilleries, which on examination might pass the efficiency test. A few others could be refurbished so as to work efficiently. It is believed that it would be possible to produce 5 million gallons of alcohol in these distilleries, so that we should have to provide new equipment for the production of about 20 million gallons of alcohol yearly. This production could be achieved by the erection of 20 new distilleries of modern type of one million gallons capacity each during the next 5 years. As has been indicated in Appendix XIX, it will be more convenient in some areas to have smaller plants, while in other areas the sizes of the plants may be larger. The total cost of erection of the new plants will be two crores of rupees approximately.

101. Production of Power Alcohol from Sources other than Molasses. - The Panel is of the opinion that it is not possible in the present circumstances to recommend the manufacture of power alcohol from sources other than molasses, as such manufacture is not likely to be economical. It is most important, however, that efforts should be made to develop an alternative cheap indigenous source of production of power alcohol and rectified spirit, simultaneously with the full development of the power alcohol production outlined in this report. The greater portion of the available molasses will be used up in making power alcohol, and the demand for alcohol for industrial purposes, which is likely to increase steadily with the growth of the fine chemicals, drugs and other industries, will be difficult to meet satisfactorily, unless means are found to increase the total production of alcohol.

102. Research Organisations.—Research organisations should be established to work out improvements in the manufacture of alcohol and to keep abreast with the latest developments. These should carefully explore the possibility (a) of manufacture of industrial and power alcohol from sources other than molasses at economical prices ; (b) of utilisation of alcohol for the manufacture of different chemicals ; and (c) of its employment in various industries.

103. Excise Duty on Industrial Alcohol.—The Panel considers that in order to encourage industries using alcohol as raw material it is necessary, as in the case of salt, not to charge any excise duty on alcohol used for industrial purposes other than as motor fuel.

104. Inter-Provincial Excise Barriers.—The manufacturers and distributors of spirituous preparations and products containing alcohol have been greatly inconvenienced and handicapped owing to the existence of inter-provincial excise restrictions. It is recommended that all inter-provincial barriers regarding labelling, bottling, etc. of industrial alcohol and spirituous preparations should be abolished and the whole of India should be treated as one unit.

FOOD YEAST

105. The report of the special Officer appointed by the Food Department on food yeast has been carefully considered (Appendix XXIII). The Panel is of opinion that the main difficulty regarding food yeast is not connected with the production, but with the consumption of the article. No proper scheme for the mass administration of food yeast has been worked out or seems feasible in the near future. In the absence of such a scheme it is felt that the demand for food yeast in the country, at least in the beginning, would be small and there would be considerable difficulty in disposing of an annual production of 3,000 tons. It would therefore be desirable that instead of putting up a factory of the latter capacity, Government should at the outset encourage sugar factories or other manufacturers to put up small units with a production capacity of 1 ton daily or higher.

106. The Government should guarantee to take over the entire production of such factories during the first 3 years at a fixed price. Tenders should be invited from intending manufacturers on this basis.

107. The responsibility for the distribution of food yeast should be taken up by the Government. Food yeast may be tried in the first instance in institutions ; but its use should at the same time be encouraged both in rural and urban areas by propaganda through all available means.

108. The quality of food yeast should be standardised ; its production should be licensed ; and there should be adequate arrangements for inspection and testing.

109. The details of the cost of installation of a 1-ton per day plant have been worked out, and are shown in Appendix XVIII. General estimates for the cost of erection of larger plants as well as estimates for the cost of production of food yeast in plants of different sizes are also given. It will be seen that the cost of a 1-ton per day plant will be about rupees 4 lakhs, including the cost of boiler house and generator. The plant would be suitable for operation by a sugar factory.

RECOMMENDATIONS OF THE PANEL.

Sugar Industry.

110. **Target of production** :—The target of production at the end of 5 years should be 16 lakh tons of sugar; 15½ lakhs for internal consumption and 50, 000 for export outside India.

111. **Expansion of existing units** :—Factories with a crushing capacity of more than 250 tons and less than 800 tons daily should be encouraged to expand to the latter capacity, if there are reasonable prospects of extra cane being found within an economic distance. All factories should be allowed to improve their efficiency by installing upto 2 sets of cane knives and upto 17 rollers and enlarge their boiling house capacity.

112. **Installation of new sugar factories** :—It is recommended that 20 new units each of annual production capacity of 10,000 to 12,000 tons of sugar should be installed as early as possible.

113. **Location of new factories** :—It is understood that the Government of India has already given its approval to the erection of 5 new sugar factories, one each in Travancore, Hyderabad, Baroda, N. W. F. P. and Bihar. Sites, therefore, remain to be chosen for only 15 new units. It is recommended that 3 of the units should be allotted to Madras, 3 to Bombay (one of which may be reserved for the Deccan States group), 3 to the Punjab (1 being reserved for the Punjab States), 3 to Bengal, 1 to Assam, 1 to Orissa and 1 to Sind.

114. **Time limit within which preliminary arrangements for new projects must be completed** :—As the need for increasing production is urgent, the promotors of new projects should be allowed a period of not more than eighteen months within which to make all preliminary arrangements, financial and otherwise, and to place final orders for machineries. If the Provinces to whom additional units are allotted are not able to make these arrangements within two years, the lapsed capacity should be allotted elsewhere. The order in which such capacity should be allotted to other parts is suggested in para. 21 of the report. Similarly, if the estimated increase of production by one lakh tons by way of the extensions of the existing factories does not take place within a period of 30 months, the position should be re-examined and the shortage made up by fresh allocation of new plants.

115. **Shifting of sugar factories** :—It may be necessary in certain cases, when factories cannot get sufficient cane to meet their daily requirements or cannot run for an average number of days for want of cane, to split and shift part of factory to some other area. This will be permissible provided the aggregate crushing capacity of these split up units does not exceed the capacity of the original plant.

116. **Need for State Control** :—It is not necessary or desirable to run the sugar industry under State ownership or management. State control over the production, prices and distribution of sugar is, however, necessary.

117. **Matters to be subjected to Central Control** :—It is recommended that the following matters should be subject to Central Government control, which should, however, be exercised in close collaboration with the Local Governments :—

(a) location of new factories and of existing factories when shifted to new sites ;

(b) sizes and specification of plants and additions to and alterations in existing units, with the object of ensuring that the crushing capacity does not exceed the capacity sanctioned;

(c) prices of sugarcane and sugar ;

(d) production of sugar including allotments of quotas to various regions and individual factories ;

(e) distribution of sugar including allocation of sales quotas to individual producing areas and factories and allocation of supplies from individual factories to various regions with a view to avoid cross haulage and to minimise the cost to consumers. In doing this the normal markets in pre-war days of factories should be taken into consideration ;

(f) the fixation of carry over each year and its distribution amongst the factories ;

(g) conditions of labour ;

(h) exports including control over policy, quota, packing and prices ; and

(i) production, quality and prices of special sugars and confectionery.

118. **Existing Local Legislation to be abrogated** :—All provincial legislation dealing with matters proposed to be brought under the Central control will have to be abrogated and replaced by a Central statute. Provinces will obtain delegated powers in respect of functions entrusted to them. All local cesses on cane should be abolished if they are incompatible with the all-India control and policy.

119. **Central executive Authority** :—The executive powers as regards Central control should be vested in an official Controller. He should have a representative central Board consisting of not more than 7 representatives of the Governments of various regions, 7 representatives of the industry, 2 of consumers, 4 of cane-growers and 2 of labour to advise and assist him on matters of policy, and a small Technical Committee to advise on problems regarding the extensions of factories, replacement of machinery and generally on matters affecting the technical efficiency of the industry.

120. **Marketing Organisation**—The actual distribution of sugar should be by an organization the membership of which should be compulsory for all sugar factories. This marketing organization or the Controller should levy a charge of one or two annas per maund to meet any financial obligations regarding export, and to compensate individual factories, if necessary, for storing sugar, surplus to the requirements of any particular year.

121. **The need for Indian States having a common policy** :—The Panel considers it desirable that the policy of the Indian States in respect of the production, prices and distribution of sugar should be in line with the all-India policy. The States should participate in the operation of the all-India control on the same basis as the British Indian provinces.

122. **Reduction in the price of sugar desirable : measures required** :—Efforts should be made to reduce steadily the cost of sugar. This is the only sure way to lead to a greater consumption of sugar in the country. The cost of sugarcane is a most important item in the cost of sugar. It is essential that steps should be taken to produce sugarcane cheaper and achieve a higher recovery of sugar from cane. The lowering of cost of sugar should also be achieved by increasing the efficiency of the factories, limiting of profit and lowering of the excise duty.

123. **Protection to continue** :—It will be necessary to continue the tariff protection during the next 5 years. The quantum of protection required will, however, depend on the comparative cost of production in this country and Java when normal conditions return. The matter will have to be considered in due course by the Tariff Board. Meanwhile, the existing duty should be extended.

124. **Excise duty**.—Excise duty is directly related to the import duty. The existing import duty is at a level which enables Indian sugar industry to compete with Java after the payment of excise. The imposition of excise duty, however, increases the cost of sugar to the consumer and results in curtailment of consumption. It is recommended accordingly that both the excise duty and the protective duty should be gradually reduced.

125. **Khandsari sugar to pay the same excise duty as sugar produced by vacuum pan factories** :—The excise duty on Khandsari sugar is at present Re. 0-8-0 per cwt. as against Rs 3 per cwt. on sugar produced by vacuum pan factories. The Panel is of opinion that Khandsari is a wasteful process of producing sugar and the quality of the production is inferior. The special concession at present granted to Khandsari sugar should be withdrawn and the same excise duty should be levied on it as on sugar produced by vacuum pan factories

126. **Bounties and expert advisory service** :—The Panel is of opinion that the sugar industry does not need any bounties as it is receiving and will presumably continue to receive the necessary protection through the Tariff Policy. It does not also require any special expert advice from abroad, except for fabrication of machinery. A competent advisory service should, however, be organised to inspect factories and to help them in improving their technical efficiency. The existing Institute of Sugar Technology should be able to give this service provided its staff and equipment are suitably augmented.

127. **Need for intensification of agricultural and technological research** :—Research both agricultural and technological, should be intensified with particular reference to the conditions in the different parts of the country. The present Central Government grant of 0-1-0 anna per cwt. from excise duty should be increased to 0-4-0 annas per cwt.

128. **Utilisation of by-products** :—In addition to the measures to be adopted for the proper utilisation of molasses by the production of power alcohol and food yeast, steps should be taken to organise research to make suitable use of press mud and bagasse.

129. **Comparative duty on finished machinery and raw materials for manufacture of machines** —The Panel is of opinion that the duty on component parts or raw materials from which machinery for the sugar industry is made should, in no circumstances, be higher than the duty on finished machinery.

130. **Confectionery and special sugars** :—The manufacture of confectionery and products such as sugar cubes, demerara sugar, icing sugar, jams and squashes should be encouraged. The Tariff Policy in respect of manufactured goods of which sugar is an important ingredient should be revised by increasing the import duty on them to a level

that would place the sugar imported in indirect forms at par with ordinary imported sugar.

131. **Requirement of capital goods** :—It is estimated that the total cost of machinery required for (a) fuller exploitation of the existing capacities of the sugar factories ; (b) enlargement of the capacity of the existing small plants ; and (c) construction of 20 new factories of 1000 tons cane per day capacity will be about rupees 11 to 12 crores. It is most desirable that sugar machinery should be fabricated as far as possible in India. Prices of machinery abroad are now abnormally high and they are difficult to obtain. Machinery produced in India may be cheaper and will be available earlier. The latter is an important consideration for enabling us to carry out the programme of expansion according to schedule. The Panel recommends that a central expert-organization should be set up for ascertaining requirements, for classifying and consolidating them for the programming of supply, for the preparation and supply of design and for organising contacts between factory owners and engineering workshops.

POWER ALCOHOL

132. **Object of developing the power alcohol industry : Target of production :** —It is desirable to develop the power alcohol industry in India with the objects primarily :

(a) of establishing an alternative source of motor fuel partially to re-place petrol the indigenous supply of which in the country is short ; and

(b) of utilising the surplus of molasses which is wasted at present.

The Panel recommends that 20 million gallons of power alcohol per annum should be produced from molasses by the end of the next 5 years.

133. **Power alcohol to be used as motor fuel in admixture with petrol : Most suitable mixture** :—Power alcohol should be used as motor fuel in admixture with petrol. A mixture of 20% power alcohol and 80% petrol is considered most suitable for this purpose.

134. **Size of distilleries** :—The standard size of distilleries for the production of power alcohol should be of 1 million gallons capacity, but a smaller size of half a million gallons capacity may be allowed in special areas having a smaller output of molasses. Units larger than 1 million gallons capacity may also be permitted in certain cases.

135. **Ownership of distilleries** :—Sugar factories should be divided into groups each capable of meeting the molasses requirements of one distillery. Each distillery may be owned jointly by factories supplying the molasses, share of each sugar factory in the distillery being in proportion to its capacity for supplying molasses.

136. **Supply of molasses** :—While the sugar factories might be given an option to join as shareholders of the distillery, the selling of molasses to the distillery in proportion to the crushing capacities of the factories should be made compulsory.

137. **Licensing of distilleries** :—It is proposed that all distilleries should be licensed.

138. **Survey of the existing distilleries** :—A careful survey should be made to find out which of the existing distilleries are properly situated in respect of their supply of molasses and could be suitably refurbished and extended for the economical production of alcohol. These should be given an opportunity to expand to the prescibed limit. If they are unable to make the necessary extensions, they should be replaced by new ones. It may be worthwhile in certain cases where the distilleries are wrongly located to shift these to more suitable places and the Government might meet a part of the cost of removal in such cases.

139. **Location of standard distilleries** :—The standard sized distilleries should be situated mostly in the United Provinces and Bihar which are the main sugar producing areas. Suggestions have been made for the locations of 20 distilleries for the production of power alcohol and for the grouping of the sugar factories for supply of molasses to these distilleries.

140. **Mixing** :—The mixing of power alcohol with petrol should be compulsory in such proportions as might be prescribed and in such areas as are notified from time to time. The mixing should be carried out in the petrol storage depots at present run by the different oil companies.

141. **Areas Supplied by power alcohol and petrol mixture** :—Power alcohol should at first be put in use in the United Provinces and Bihar and areas round them where it would be easily available in required quantities. The total areas supplied by the mixture should progressively expand with the increasing production of power alcohol.

142. **Control over power alcohol and molasses: Appointment of Alcohol Commissioner:**—The production, distribution and price of power alcohol and the movement, price and quality of molasses should be under the control of the Central Government. The control should be exercised by an Alcohol Commissioner appointed by the Central Government. The Sugar Controller might, with advantage, be appointed as the Alcohol Commissioner in addition. He should be assisted by a Committee having the same powers as in the case of sugar.

143. **Expert adviser** :—The appointment of a firm or firms as consultants, is not considered to be necessary, but it is desirable that an expert should be attached to the Alcohol Commissioner to help and advise the industry on the fabrication of plants and the production of alcohol.

144. **Transport of molasses and power alcohol : Necessity for the reduction of Railway freights** :—The development of the power alcohol industry will lead to a large increase in the traffic in molasses and power alcohol. In order to reduce the selling price of power alcohol which would make its use feasible, it is essential that the railway freight for power alcohol and molasses should be kept as low as possible.

145. **Sales organisation :**—The distribution and sale of power alcohol should be carried out for the present by the existing oil companies. A scheme for the marketing of power alcohol on an all-India basis at a uniform price has been worked out.

146. **Addition of denaturant** :—The addition of denaturant appreciably increases the cost of power alcohol. The Panel, however, considers that it will not be practicable to eliminate the use of denaturant. The most suitable denaturant for power alcohol would be petrol. 5% petrol should be added to power alcohol before it is sent out of the distilleries for transport to the mixing depots.

147. **Cost of power alcohol** :—It is considered that on the basis of 6 annas per maund as the price of molasses the cost of production of power alcohol in standard distilleries of capacity of 1 million gallons per annum would be about 8 annas per gallon. The cost of power alcohol to the consumers might be somewhat higher than that of petrol, although the mixed fuel which will contain only 20% power alcohol should not cost more than 1½ to 2 annas per gallon higher than that of unmixed petrol.

148. **Excise duty on power alcohol** :—The Panel considers that in view of the strategic importance of the development of the power alcohol industry an excise duty lower than that on petrol should be charged on power alcohol so that power alcohol petrol mixture may be available to the consumers at the same price as unmixed petrol.

149. **Fabrication of distilleries : Costs of Erection** :—New equipment will have to be provided for the manufacture of 20 million gallons of power alcohol per annum. The total cost of erection of the new plants is estimated to be about rupees two crores. As far as possible the distillery plants should be fabricated in this country. Patent rights should be acquired by the Central Government where necessary from the foreign manufacturers.

सत्यमेव जयते

150. **Production of power alcohol from sources other than molasses** :—The Panel is of opinion that it is not possible in the present circumstances to recommend the manufacture of power alcohol from sources other than molasses as such manufacture is not likely to be economical. It is most important, however, that efforts should be directed to the development of alternative cheap indigenous sources of production of power alcohol and rectified spirit.

151. **Subsidiary Industries** :—Attention should be paid to the development of the manufacture of solvents such as butyl alcohol and amyl alcohol, and for the production from ethyl acetate, ether, chloroform, etc. Efforts should also be made for suitable utilisation of the spent effluent from the distilleries and for the manufacture of "dry ice" from carbon dioxide which is produced in the process of manufacture of alcohol.

152. **Research Organisation** :—Research organisation should be established (a) to work out improvements in the manufacture of alcohol; (b) to keep abreast with the latest developments in other countries; (c) to explore sources other than molasses for the manufacture of industrial and power alcohol at economical price; and (d) to develop the use of alcohol in various industries and its utilisation in the manufacture of different chemicals.

153. **Excise duty on industrial alcohol** :—The Panel considers that in order to encourage industries using alcohol as raw material, it is necessary, as in the case of salt, not to charge any excise duty on alcohol used for industrial purposes other than as a motor fuel.

154. **Inter-provincial excise Barriers** :—It is recommended that all inter-provincial barriers regarding labelling, bottling, etc., of industrial alcohol and spirituous preparations should be abolished and whole of India regarded as one unit.

FOOD YEAST.

155. The Panel is of opinion that the main difficulty regarding food yeast is not connected with the production, but with the consumption of the article. The demand for food yeast in the country in the beginning is likely to be small and the Panel thinks that there will be considerable difficulty in disposing of an annual production of 3000 tons recommended by the special officer of the Food Department.

156. The Government of India should at the outset encourage sugar factories or other manufacturers to put up small units with a production capacity of about 1 ton a day. The cost of erection of such a unit will be about Rs. 4 lakhs including the cost of boiler house and generator.

157. The Government of India should guarantee to take over the entire production of such units during the first 3 years at a fixed price and should take up the responsibility for the distribution of food yeast.

158. Food yeast may be tried in the first instance in institutions; but its use should at the same time be encouraged both in rural and urban areas by propaganda through all available means.

159. The quality of food yeast should be standardised ; its production should be licensed ; and there should be adequate arrangements for inspection and testing.

Shri Ram — Chairman.
R. C. Srivastava
Vishnu Sahay
S. M. Dhar
*B. C. Guha
*Lalchand Hirachand
M. B. Amin
*W. H. A. Webb
Shankar Prasad
Karamchand Thapar
Gursharan Lal — Members.

M. K. Maitra — Secretary.

सत्यमेव जयते

NOTE BY MR. LALCHAND HIRACHAND

While I sign this report I should like to add a note to clarify some of my ideas. Personally I think that it would be unwise to impose the controls too rigidly whereby the initiative of the enterpriser will be lost. In this connection I would particularly draw the attention to (2) of paragraph 22 by which it is proposed to restrict alterations in plant. To prevent unauthorised increase in crushing capacity the best thing is to give production quota and leave the internal organisation entirely to the Factory management. The controls should, therefore, be restricted to safeguarding certain interests such as labour, the grower and the consumer and should be enforced in such a way that the Industry will be able to maintain its progress.

NOTE BY DR. B. C. GUHA

1. I would not agree with the proposed distribution of the new sugar factories. Bengal is both a large consuming province for sugar and has also a soil which is very suitable for the production of cane. From both these points of view Bengal is in a better position than many other provinces. I would suggest the number of sugar factories allotted to Bengal should be raised from 3 to 4. The relative lack of development of the sugar industry in Bengal should be no justification for the refusal to allot 4 new factories to that province. It should, however, be stipulated that unless the construction of these 4 factories is under way within two years, these factories may be allotted to other provinces. It is obvious that if producing and consuming areas largely coincide, that is the best arrangement from every point of view and that is an essential part of industrial planning.

2. Regarding food yeast, I do not agree with the recommendation of the Panel. A Food yeast factory with a capacity for the production of 10 tons a day would be much more economic than units with a capacity for the daily production of one ton. If yeast is to be fed to the poorer sections of the population who are mal-nourished, the material should be produced at as low a cost as possible. Even a factory with a production capacity of 10 tons a day producing roughly 3000 tons a year would produce just enough material to feed about one million people. This is indeed a very small proportion of the total population of India. It should not be difficult to arrange distribution of this amount of yeast to selected groups of people, particularly the vulnerable groups of the population, in selected institutions This factory should preferably be established by Government who should also supervise distribution. This does not preclude other manufacturers from putting up small units with whatever production capacity they desire.

NOTE BY MR. W. H. A. WEBB.

As I understood it, my appointment to the Panel on Sugar, Alcohol and Food Yeast was in the capacity of a technician having knowledge of Alcohol and Food Yeast manufacture and machinery. No other technician with experience of this equipment was a member.

As such a technician I have avoided all questions concerning Sugar and all questions of policy unless Technical considerations played an important part in them.

In my view, the recommendations of the Panel are not always in line with the creation of an efficient Alcohol Industry nor do I think the Wide Issue of Food Yeast has had fair consideration.

The Committee has been unable to discover any raw materials, other than molasses, which would permit the production of power alcohol at wholesale selling prices below 2s. per gallon in capital cities. Raw materials from which alcohol could be made and sold at this price are :—

(i) Sugar, provided that a large distillery is built adjacent to an existing raw sugar mill from which clarified cane juice is obtained. and that the sugar is purchased at a price equivalent to £9 per ton for 94 net titre sugar f.o.b. Queensland ports ;(ii) wheat, provided that large distilleries are built in favourable localities and that wheat is available to these distilleries at a price of 3s 6d. or 3s. 10½d (depending on the process used) per bushel f.o.r. shipping ports.

Alcohol could also be produced from grapes at 2s. per gallon, but only if production were subsidized from the amunt of£2, 00, 000, per annum previously paid as a bounty on exported wine (about 4s 6d.per gallon of power alcohol was suggested). Since the production from grapes would be only some 800, 000 gallons per annum, it would be of little interest from the standpoint of motor fuel supplies The main value of the proposal lies in the stability it offers to the grape industry during the war, but the committee does not consider it necessary to do more than draw the attention of the Government to the proposal.

The cost of construction of a distillery of 5. 000, 000 gallons annual capacity would be in the neighbourhood of £5, 00, 000, so that amount required for an annual production of 45 000, 000 gallons would be about 4,500,000 working capital to be provided in addition to this would depend on the system of trading adopted, but need not amount to a large sum. The manufacturing cost, including interest on capital but excluding cost of raw materials and transport, is estimated to vary from 7d. to 9d. per gallon, according to the type of distillery and raw materials. To this must be added the cost of transporting either the raw material or the finished product. The sum of these costs together with raw material costs equivalent to about£9 per ton 94 net titre sugar f.o.b. Queensland ports or 3s. 6d (malting process) to 3s. 10½d. (amylo process) per bushel for wheat for shipping ports, will result in alcohol at 2s. per gallon. The committee suggests that this price should be the maximum selling price of power alcohol, wholesale in capital cities. In both caces these prices for sugar and wheat are close to export prices.

Replacing petrol by 52, 000, 000 gallons of alcohol at 2s. per gallon, wholesale in capital city, would cost the Australian Community, at present prices, a total of £31, 42,000 of which£24, 70, 000 is Government revenue. Spread over the annual petrol consumption (350,000,000 gallons)the total extra cost corresponds to 2. 15d. per gallon, made up of 1.69 d. for Government revenue and 0. 46d. for extra cost of alcohol. Since the alcohol-petrol blend is a super grade and some 50 per cent. of consumers are willing to pay 1d. . per gallon more for this, the sum of 2. 15d. is reduced to 1. 65d. when allowance made for the value received. At pre-war prices, the extra costs are higher.

Although the cost of power alcohol is considerably higher than that of imported petrols, there are important national and social advantages to offset this. Two main benefits which must be weighed against the extra cost are (i) defence value and (ii) stabilization of agriculture. At the present time the defence value is paramount and on this aspect alone it seems justifiable to expand productions. In addition, the stabilizing effect of the industry on agriculture by providing a home market for some proportion of the unexportable wheat and sugar, is considered important enough to justify considerable expansion of the alcohol industry. There is no intention that encouragement should be given to the production of wheat and sugar above present levels to order to supply material for power alcohol ; on the contrary the raw material for this expanded industry should come from present production unable to be exported. Unless this is done, stabilization will not be effected.

Producers of wheat and sugar would hesitate to enter into the necessary long-term contracts to supply their products at the prices mentioned. This uncertainty in contracts for raw materials, together with the rate of interest on capital taken in the cost estimates, would not make the proposal attractive from the point of view of private investment. Furthermore private investors would obviously not support a project for the establishment of factories to operate for a short time only. For these and other reasons, it is suggested that either the capital should be provided by the Government, or there should be a combination of Government support and private investment ; constructions and operation of the plants should be delegated to companies experienced in the industry. In both these cases, means af preventing undue expansion in the industry would be in the hands of the Government.

The Committee considers that, if the erection of distilleries is undertaken at once, it should be on the basis of operation for five years from the beginning of production, and the position should then be reviewed. A decision, based on the state of affairs at that time, could then be made as to the future of the industry. Since power alcohol production would be under Government control, the policy then to be followed would clearly lie in the Government's own hands.

In an Interim Report, submitted on 28th march, 1941, the Committee recommended that the Government should take immediate action (i) bring the production of the three existing power alcohol distilleries up to full capacity by using raw sugar; (ii) to investigate the production and use of 95% alcohol as a motor fuel. The point of the second recommendation is that there are many small distilleries scattered throughout Australia capable of producing 95% alcohol. Although this is not nearly as suitable as anhydrous alcohol for use as a motor fuel, its production and use in an emergency is worth consideration.

Finally, it is necessary to enumerate the reasons behind the Committee's decision to recommend an immediate large expansion of the power alcohol industry, despite the high cost of alcohol as a liquid fuel. The reasons are as follows :—

(a) there is an immediate and urgent need for greater quantities of indigenous liquid fuel than are produced at present ;
(b) there is need for some new outlet for surplus and unmarketable crops (in particular wheat and sugar) until normal trade relations are resumed ;
(c) the Committee assumes that the Government has not, at present, any more satisfactory way of meeting these two needs ;
(d) the Committee considers that the Government should, owing to the great importance of liquid fuel in the defence and economy of Australia, be prepared to face the costs to the community that might follow the adoption of the committee's recommendations. The recommendations are made with the knowledge that owing to changed conditions, the expanded industry might eventually have to be curtailed ;

(e) the Committee wishes to recored that the information put before it is sufficient to support the recommendations.

Recommendations.—

The Committee makes the following recommendations :—

I. Immediate action should be taken to erect distilleries to produce 40,500,000 gallons of anhydrous alcohol per annum. If 95% alcohol should prove unsuitable or unprocurable as a motor fuel, this capacity should be raised to 45,500,000 gallons. These distilleries should use wheat and sugar-cane products, in proportions having regard to—

(a) strategic considerations ;
(b) the proportion of surplus wheat and sugar to be used as raw material ;
(c) each State's requirements of liquid fuel ;
(d) the time needed to erect distilleries.

II. The selling price of power alcohol, wholesale at capital cities, should be 2s. per gallon. This is estimated to give a price for sugar-cane products equivalent to about £9 per ton 94 net titre sugar f. o. b. Queensland ports, and a price for wheat of 3s. 6d. (malt process) or 3s. 10½d. (amylo process) per bushel f.o.r. shipping ports. In making this recommendation, the Committee assumes that suitable power alcohol blends would be sold as super grade at a premiun of 1 d. per gallon.

III. Sites of distilleries should be decided by :—

(a) strategic considerations ;
(b) location of the source of raw material ;
(c) centres of distribution of liquid fuel.

IV. The distilleries should be owned by the Commonwealth with or without the participation of State Government and/or private interests. Arrangements should be made with experienced organizations to operate them.

V. There should be Governmental action, preferably by State legislation, to ensure :—

(a) the sale of all alcohol of which the selling price is reasonable ;
(b) the best use of such alcohol, by blending with standard grade Petrol in the proportions necessary to produce super grade, or by blending with petrol of lower grade than standard in the proportions necessary to produce standard grade ; and
(c) the sale of alcohol-petrol blends of suitable quality as super fuel under distinctive names indicating the presence of alcohol.

The blend should be sold through the established channels of motor fuel distribution

VI. A decision should be made before the end of five years of operation as to whether distilleries will thereafter :—

(a) continue in operation ;
(b) be maintained idle as provision against further emergencies ; or
(c) be dismantled.

APPENDIX XXIII.

Report of Special Officer appointed by the Food Department Government of India on FOOD YEAST.

The question of the manufacture of Food Yeast in India first came before the Government of India in 1941. The Secretary of State sent personally to His Excellency Lord Linlithgow a large quantity of literature on Food Yeast and suggested that we should manufacture it on a large-scale. After consultation with E. H & L. Department and the Supply Department it was decided that the Supply Department should undertake this matter. It was likewise decided that a unit capable of producing 10,000 tons of Food Yeast per annum should be set up as soon as possible and that Messrs. Parry & Co. of Madras would undertake to put this project into effect. At about this time a technical Committee under Sir S.S. Bhatnagar was set up to report on the feasibility of the enterprise. Their report was favourable but not enthusiastic.

2. Messrs. Parry & Co. proceeded with the installation of a small pilot plant at Nellikuppam (Madras) which was a duplicate of the pilot plant erected at Teddington, (London) and capable of producing approximately 400 lbs. per day of Food Yeast. It soon became clear that Parrys could not secure sufficient molasess for a 10,000 ton Food Yeast plant. Their interest was limited to production on pilot plant scale and as a result the whole question of large-scale production was dropped. At the present moment Parrys are not producing any dry Food Yeast. They are converting Yeast Cream into Yeast Extract which is being purchased by the Food Department. However, Parrys have produced a small quantity of Food Yeast similar to that produced at Teddington, but the product is inferior in both colour and taste to the Teddington Food Yeast (It is possible that this would not have been the case had Parrys used either aluminium or stainless steel fermenting vessels instead of mild steel). It may be noted here that there is no factory at present producing Food Yeast in India.

3. During the period 1941-1944 and whilst these experiments were taking place in India the question of the manufacture of Food Yeast was receiving considerable attention in Great Britain where experiments were proceeding satisfactorily. It is interesting to note that a company called the Food Yeast Co Ltd. was formed by the Ministry of Food whose object it was to produce Food Yeast on a large-scale in both the United Kingdom and British Colonies.

4. The increasing stringencies of the shipping situation and the consequent impossibility of finding shipping space for the molasses required, led to the abandonment of the plan to manufacture Food Yeast in the United Kingdom. Nevertheless the Food Yeast Co., Ltd , was kept in existence with a view to acting as distributing agents for such supplies of Food Yeast as might become available from elsewhere.

5. The Colonial Office took up very seriously the proposal to manufacture Food Yeast in the Colonies. Their interest was three-fold :

(a) to find a cheap source of highly nutritive food-stuffs much needed by the poorer sections of the Colonial people,

(b) to establish, on a long term policy, a new and profitable utilisation of surplus molasses and sugar and

(c) to enable the Colonies to increase their contribution to war-time as well as post-war needs.

The Colonial Office satisfied themselves that Food Yeast was of outstanding value and combined its high nutritive qualities with excellent keeping qualities. Food Yeast offered considerable convenience for shipping, required no refrigeration and was vastly more compact than equivalent quantities of protein in the form of meat.

6. Further investigation and the promising results of the experiments being carried out at Teddington caused the Colonial Office to decide to set up with the shortest possible delay a complete Food Yeast plant in Jamaica capable of producing 3,000/4 000 tons of Food Yeast per annum. As this was a pioneer venture it was decided that it should receive the assistance of public funds provided under the Colonial Development and Welfare Act, 1940. Col. Rt. Hon'ble Oliver Stanley, M. C., M.P., Secretary of State for the Colonies, accordingly made a scheme under that Act providing as interest-free loan of £1,50,000/- for this Jamaica project. To administer the scheme Colonel Stanley set up a company named the Colonial Food Yeast Ltd.

7. With the assistance of specialised manufacturers in Great Britain the Colonial Food Yeast Ltd proceeded to design and manufacture a complete industrial unit which is expected to go into production on the Jamaica site in the very near future (June/July, 1945). All technical data and information regarding the Jamaica

plant will be supplied by the Colonial Food Yeast Ltd. upon receipt of any enquiry which is sponsored by the appropriate Governmental authorities. In such cases, they will accept, if necessary, to act as Consultants and co-operate in both the design as well as the erection of plant under an appropriate agreement.

8. In view of the technical progress which had been made in Great Britain regarding the setting up of a scheme to manufacture of Food Yeast on an industrial scale, and partially due to the lack of progress which was being made to set up a similar scheme in India during the same period, the Secretary of State commissioned Mr. N A. McKenna in February, 1944 to investigate the situation in India and find out whether the Government of India would sponsor the setting up of a unit similar in all respects to the Jamaica plant and capable of producing some 3000 tons of Food Yeast per annum. It was known that a very large surplus of molasses was available in India and was being produced in sufficient quantity to enable a Food Yeast Factory of this capacity to be set up in any one of several localities. It was also known that the surplus molasses available could be obtained at very little cost and that Food Yeast could therefore be produced in India very cheaply. After consultation with the authorities as well as with Mr. Henry J. Lawless, who had also been deputed to advise the Government of India on technical questions relating to the manufacture of Food Yeast, Mr. Mckenna submitted a Memorandum to the Food Department setting forth the numerous advantages of Food Yeast as a highly nutritive food and the benefits which would result if such a food could be made available to the under-nourished people of this country. This memorandum contains an exhaustive survey of the beneficial aspects of Food Yeast.

9. The new interest which was awakened in this question through the information given by Messrs. McKenna and Lawless caused the Food Department to reopen the matter with vigour and enthusiasm and, as a result, a Committee was formed consisting of:

Dr. Sir S S. Bhatnagar, Chairman.
Mr. K. L. Panjabi, I.C.S., Joint Secretary,
Deptt. of Food (Division III).
Dr. J.N. Ray, Director of Drugs & Dressings,
Supply Department.
Dr. G. Watts Padwick, Imperial Michologist.
Dr. H. D Sen, Biochemist, Sugar Technology
Institute, Cawnpore.

This Committee was appointed to investigate the following questions :—

(a) the desirability of having a Central Yeast Factory of the capacity proposed,
(b) the nature of the ownership and control,
(c) the selection of site,
(d) the method of disposal of effluent and
(e) the method of disposal of Food Yeast.

10. Upon the recommendation of this Committee the undersigned was appointed Officer on Special Duty and his terms of reference were :—

(a) to report on the best site for the location of a Factory for the production of Food Yeast,
(b) to report on the best method for the disposal of the effluent from the factory,
(c) to report on the agency of consturuction as well as the running of the Factory and
(d) to report on the best method of utilisation of Food Yeast from the nutritional point of view.

11. (a) Best Site and (b) Disposal of Effluent.

Choice of the most suitable site for the location of a Food Yeast Factory and the question of disposal of the factory effluent are inter-related and must be treated as one problem. The selection of the site depends upon the following factors which are set down in their respective order of importance.

(a) Proximity to source of raw materials (molasses).
(b) Transport facilities.
(c) Disposal of effluent.
(d) Availability of power.

12. A 3,000 ton p.a. Food Yeast factory will require the provision of approximately 10000/12000 tons of molasses per annum. This quantity of molasses can be supplied by one or more Sugar Factories which, together, have a total crushing capacity of

3,00,000/3,60,000 tons per annum or about 2,500/3,000 tons of cane per day for 120 days. There are many localities in the U.P. and Bihar where a group of 2 or 3 Sugar Factories in close proximity of each other can supply the required quantity of molasses and therefore from this point of view there is a large choice of sites available. Any one of these would be suitable as regards restricting transport to a minimum but not all of them are suitable when considering the problem of disposal of effluent. Choice must therefore be restricted to the few points where all these questions can be suitably solved and investigated as proceeded on these lines.

13. There are several methods which could be adopted for disposal of effluent which in the case of a 3,000 ton Food Yeast Factory amounts to approximately 10,000/12,000 gallons per hour. Without going into unnecessary details regarding the more costly and chemical methods of treating factory effluents it is admitted that the cheapest and the easiest means of disposal consists in discharging the effluent into a large river canal, or as in the case of Jamaica directly into the sea. This later means connot be considered in India because there are no Sugar Factories capable of producing the required amount of molasses in reasonable proximity to the sea. Certain sites however do offer the possibility of dumping the effluent into a river or canal and of these the best appear to be :—

(1) Head works of Sarda Canal at Bambasa. (U.P.)
(2) Near Patna on the river Ganges (Bihar).
(3) Jawalapur on the Ganges Canal below Hardwar (U.P.).

14. The Head works of Sarda Canal are in the Tarai area which is notoriously malarious. Thus it would be very difficult to maintain the staff in good health and this would result in defective operation if not frequent stoppages of the Factory. Furthermore it is also an out-of-the-way place from the point of view of transport etc and therefore the cost of distribution of the final product would be relatively and unnecessarily high. For these reasons this site cannot be strongly recommended.

15. Jawalapur and the site near Patna may be said to be equally suitable from the effluent disposal point of view. The minimum flow of the Ganges Canal below Hardwar is about 4 000 cu.ft. per second whereas the flow of the river Ganges at Patna is many times greater. Within a radius of 100 miles of both these sites there are enough Sugar Factories to supply a 3,000 ton Food Yeast Factory with all their molasses requirements.

16, The site at Jawalapur is preferred for two reasons. The first is because near this point the river Ganges (which feeds the Ganges Canal) comes out of the mountains and, being mostly snow-fed, the temperature of the water is consequently very much cooler than at Patana. The second and perhaps less important reason for the selection of the Jawalapur site is that the effluent which is rich in potash and also contains small quantities of phosphates and nitrogenous matter will increase the manurial value of the Canal water which is used by the cultivators for irrigation purposes. Although the actual increase in manurial value to the waters of the Canal will be extremely small it is never-theless important to note that the effect of discharging the effluent into the Canal will be beneficial rather than harmful. During the annual closure of the Canal for inspection and repairs, the effluent from the Factory could be discharged into the sewers of the Hardwar Municipality which are discharged directly into the Ganges river.

17. Before leaving the subject of the disposal of effluent by dilution or discharged into rivers or canals it would be well to mention here that the standards recommended* by the Royal Commission on sewage disposal have been published. These standards show that with the dilution of over 500 volumes all tests might be dispensed with the crude sewage discharged without harmful results. On this basis the effluent from a 3000 ton Food Yeast Factory discharged into the Ganges Canal at Jawalapur would be diluted approximately 8000 times-- a very large safety factor.

18 The proposed site at Jawalapur is equally suitable from the point of view of availability of raw materials and molasses could be supplied by the following Sugar Factories :

Name of the Factory. (1)	Distance from the Yeast Factory. (2)	Crushing capacity per day. (3)
1. Jai Lakshmi Sugar Co. Ltd., Doiwala.	25 miles.	400 tons.
2. Rai Narain Singh Sugar Mills Ltd., Lashkar.	12 ,,	1250 ,,
3. The Lord Krishna Sugar Mills Ltd., Saharanpur.	47 ,,	1250 ,,

19. The above three sugar mills could provide enough molasses to produce 3,000 tons of food Yeast. In case it is decided at a later date to double the capacity of this factory the following sugar mills could provide enough additional molasses :—

	(1)	(2)	(3)
4.	Seth Shiv Prashad Banerji Dass Sugar Mills, Bijnor.	63 miles.	1100-1200 tons.
5.	The Dhampur Sugar Mills Ltd., Dhampur.	64 ,,	950 ,,
6.	The Upper Ganges Sugar Mills Ltd., Seohara.	73 ,,	1300 ,,

20. From the above figures it will be seen that the transport of the required quantity of molasses presents little or no problem. The cost of transport of molasses by rail tank wagon is very little indeed and may be reckoned on the basis of 0 3 pie per maund per mile. Thus if the total quantity of molasses required was hauled over a distance of 50 miles the increased cost of the molasses would only be 1 anna 3 pies per md. and consequently would only increase the cost of Food Yeast by less than one pie per lb. which is relatively insignificant.

21. A further advantage of the Jawalapur site resides in the favourable climatic conditions prevailing in that area. An adequate supply of cold water would at all times be available and this is important particularly in connection with the growth of Yeast and maintenance of pure fermentation. Dr. A. C Thaysen who is in charge of the research work which has been carried out at Teddington has developed two distinct strains of Food Yeast (Torulopsis, Utilis) having an optimum growth temperature of 30°C. and 39°C. respectively. The latter will be used in Jamaica and its behaviour and development under tropical conditions will be made known to us within a few months. However we may already assume that either of the strains would be suitable to the climatic conditions at Jawalapur whereas it may only be possible to employ the 39°C. Torula if the plant was located near Patna.

22. A 3000-ton Food Yeast factory will require approximately 11000 lbs. of steam at 30 lbs. pressure per hour. It will also require about 750 K W. of electric energy. It follows therefore that if the steam is produced at 200 or 250 lbs. pressure and this high pressure steam is passed through electrical generators it will produce enough electric power to cover the Factory's needs. The exhaust steam from the electric generators can be used for sterilizing the molasses wort and for drying the Yeast Cream. The amount of extra coal required in order to raise steam at 250 lbs. pressure instead of at 30 lbs. will be approximately 8/10 %. It is interesting to note that the production of electric power by this means will cost less than half of the cost of electric power supplied by any of the Electric Supply Companies. However; stand-by power is available at Jawalapur from the U. P. Hydro-Electric Grid.

23. **Agency of Construction and running of Factory.**—There are three alternatives to choose from :—

(a) Government of India financing, erecting and operating the plant.

(b) Government of India financing a plant erected and operated on an agency basis by an industrial organisation.

(c) Government of India guaranteeing an off-take at a controlled price from a plant financed, erected and operated by an industrial undertaking.

24. There are several firms in India contemplating the setting up of Yeast Factories on a relatively small scale. They are willing to co-operate with Government but the amount of capital they have in view to investing for such Factories is only about a lac or two. The manufature of Yeast. Yeast Extract or Food Yeast will only be one of their side lines and not a main interest.

25. A factory capable of producing 3000 tons of Food Yeast per annum would require a capital of approximately 25 lacs. From the information available to-date it is believed that no private industrial concern would undertake such an enterprise unless the Government of India was prepared to guarantee to take up the entire output of the Factory at a price which would enable them to declare a 6% dividend. To do this a concern would have to earn a further 6 to 3% in order to cover income-tax, super taxes, excess profits tax, etc. This means that the capital would have to earn at least 12 to 15%.

26. The Government of India can borrow money at 3% interest and would not have to pay taxes of any description. Therefore if the Government financed, erected and operated the Factory without any outside assistance it would be possible to produce Food Yeast at a much cheaper rate. This saving of 9/10% will reduce the cost of manufacture by 20/25%.

27. The floatation of a public company could not be effected without serious difficulties and delays. In the first place the application would have to be examined carefully by the Department of Capital Issues which in turn would have to consult and obtain the approval of a number of other Government departments. Difficulties would no doubt be experienced in obtaining all the necessary priorities for the importation of plant and equipment. Other problems, such as the acquisition of land, railway sidings, purchase of essential chemicals coal for power, bricks etc., purchase of cement, structural steel and electric equipment, etc., etc., would have to be solved and many delays may reasonably be expected. On the other hand if the Government of India itself were to undertake the setting up of such a Factory most, if not all, of these difficulties would be automatically solved.

28. In addition to the above mentioned difficulties which an industrial concern would have to face there is also the question of disposal of the Food Yeast which naturally could be effected more easily by the Government. It is obvious that without direct Government intervention and backing no industrialist would be able to impose the utilisation and consumption of Food Yeast by the various Departments of the Government through whose agency the greater part of the Food Yeast produced would be consumed. The success of the Jamaica project has only been ensured due to the direct interest aud control of the Ministry of Food through the Colonial Food Yeast Ltd., and therefore it would be advisable for India to follow their wise example. At a later date when Food Yeast has become an integral part of the diet of the poor and under-nourished people of this country it will be possible to envisage the setting up of other plants by agencies outside Government control

29. Should the Government adopt the suggestion made in the preceding paragraphs it will be necessary for them to contract for the supply of all the equipment with a firm of specialised manufacturers. It is standard practice that in such cases where highly technical plant and processes have to be used that the manufacturer of the plant who is chosen to undertake the work is made responsible for the erection as well as the starting up of the complete unit. It is also usual for the plant for a certain number of months or until such time as the local staff has been suitably trained to take over the control It is suggested that a similar procedure should be adopted in this particular case and that the supplier of the Food Yeast Factory should be called upon to supervise the erection of the plant, started up, obtain the guarantees and operate it for a minimum period of 12 months.

30. It is assumed that it will take from 7 to 10 months after all technical details are settled and the order placed to deliver the plant f.o.b. A further 4 months will be required for shipment and transportation to site. Erection and starting up will occupy a further 6 months and therefore a total of from 14 to 17 months will be required to get the Factory into operation. This allows ample time to train the necessary technical staff to run the Factory. The technical staff in question should spend 3 months at Teddington and 6 to 9 months assisting in the running and operation of the Jamaica plant. At the end of this period the technical staff would return to India in time to assist in the starting up and control of the new Food Yeast Factory Only by this means will it be possible to ensure that the Factory will be built and operated on sound and scientific lines and give the highest possible efficiency camparable to that obtained in other countries.

31. **The best method of utilisation of Food Yeast from the national point of view.—**

This is being investigated by the Public Health Commissioner in consultion with nutritional experts: Dr. W. R Akroyd and Lt. Col. Thompson. Their report is not yet ready, but pending receipt of this, the following information may be included in this report.

32. It has been known for some time that micro-organisms particularly yeast, constitute one of the most potent sources of absorbable and water-soluble vitamins of the B complex and in addition form valuable sources of protein of high nutritive value containing amino acids which are essential in animal and human nutrition.

33. The most important vitamins of the B complex are :—

(a) Vitamin B_1 : (Aneurine, Thiamin and Anti-Neurotic Vitamin) prevents the disease Beri Beri.

(b) Vitamin B_2 : 1. Nicotinicamide and Acid is an Anti-Pellagra Vitamin.

2. Riboflavin is a growth promoting factor.

34. The principal deficiency of diet in India are high grade proteins and vitamins of the B complex. Animal proteins (meat, fish and eggs) are practically excluded from Indian diets partially from religious objections and partially because of their relatively high price.

35. So far as the well-to-do people are concerned they can make up their Vitamin deficiency in the form of pills and do not mind the price they pay The intention of the Government that Food Yeast should be available to the rice eating population, who are very poor and who cannot adequately nourish themselves, is a problem which remains to be solved.

36. The cost of Food Yeast, as estimated by Messrs. Parry & Co., Ltd. is Rs. 0/3/11 per lb. on a pre-war basis and 0/5/8 per lb. on the present basis. This price is based on a 20% yield of Food Yeast on the weight of Molasses used. At Teddington the yield from Molasses is over 25% and some times reaches even 30%. With the increase in percentage of yield the above cost will accordingly decrease. The exact cost of production on a large scale can only be determined after the Jamaica Plant starts producing. The cost for estimation purposes at this stage can be safely estimated at about Rs. -/3/- to Rs. -/3/6 per lb.

37. If we allow another 2½ annas for distribution charges on the above price the price to the consumer can safely be taken as Rs. -/6/- per lb. The dose of Food Yeast as recommended by the Medical Research Council is quarter of an oz. per day or approximately half a lb. per person per month, which is cheap enough to bring it within the purchasing power of the poor.

38. Unfortunately there is no means of mixing Food Yeast with rice at any stage in the milling, as the rice has a very hard outer surface. Food Yeast mixed with rice in any form will be washed away in the preliminary soaking of the rice or, when rice is boiled, in the water which is thrown away.

39. The best ways in which the rice eating population can take Food Yeast are :—

(1) Cooked with curry or vegetables and taken with rice.
(2) Mixed with spices, it can be sprinkled on rice.
(3) Boiled with pepper water (which is used in Madras and known as 'Rasam') and taken with rice.
(4) Taken with milk.
(5) Taken in sweetmeats.

40. Food Yeast can be taken more easily by people other than the rice eaters. Even in U.S.A., they find that an average individual requires an extra dose of vitamins of the B complex and accordingly all their cereals products like Post Toasties, Corn Flakes, Grape Nuts, etc. etc. are fortified with Vitamin B_1. India where the nutritional standard is very much lower than U.S.A., certainly needs extra vitamins which can be given very easily to the wheat eating population by an admixture into flour and atta with 2% Food Yeast. This will give them additional vitamins and proteins which are removed from the wheat in the milling process. This mixture can easily be controlled at the source as there are about 50 flour mills in India with a grinding capacity of about a million and a half tons of wheat per year. If all this output is fortified with 2% Food Yeast 25000 to 30000 tons will be required for this item alone. If the use of Food Yeast is properly pushed in all directions the consumption can be increased to one lakh tons, within the next 8 or 10 years.

41. Mixture of 2% Food Yeast does not make any alteration in the taste of the bread but the colour is slightly more brownish. The colour in the Chapatti will not be noticed at all. The Food Yeast is dried in the process of manufacture at 120°C. The temperature inside the bread or chapattis while baking does not exceed 100°C. This means that the vitamins will not be destroyed in the baking of the bread or chapattis.

42. Sample breads containing half an ounce of Food Yeast per one lb. loaf have been baked and distributed to some officers of this Department to find out whether they could detect any difference in the flavour of the bread There was no difference in the flavour but the colour was slightly brownish. Half an ovnce per 1 lb. loaf is the equivalent of approximately 5% Food Yeast in the flour. Therefore, if 2% only is added there will be no difference in flavour and the change of colour will be hardly noticeable.

43. Food Yeast can be given to the public in several ways such as :—

(1) All Jails to include Food Yeast in their diets.
(2) To all students in all schools who could be given Food Yeast in some form or another before play time.
(3) All hospitals to include Food Yeast in patients' diet; this will give them extra vitality which will mean more speedy recovery.
(4) All Health and Maternity Centres to advise their patients to promote the use of Food Yeast.

(5) With proper propaganda and advertisements on the lines of Aspro, Food Yeast can also become popular and be made available everywhere.
(6) It can be sold in Post Offices like quinine used to be sold years ago.
(7) It can be included in the diet of the Army.

44. Critics, in the beginning, may object to the compulsory admixture of Food Yeast in flour and the consumption of Yeast in institutions ; but if the Government consider that it is beneficial for the public, they have every moral right and power to do so. With a little propaganda and the realisation of its advantages people soon get used to it, (as they have in the case of chlorinated water which is not as pleasant to the taste as unchlorinated water). Any objection that people may have for its use will soon disappear. In England, Chalk (Calcium Carbonate) is added to all flour that is sold to overcome the calcium deficiency. Therefore, if England can oblige its people to take chalk in flour the Government of India can also easily oblige hers to take Food Yeast in atta.

Summary and Recommendations.

1. In this country, which is suffering from chronic malnutrition the establishment of a Food Yeast factory is hardly open to question.

2. It has been clearly established that Food Yeast can be manufactured in India on a large scale and at a cheap price.

3. A unit producing 3,000 tons of Food Yeast should be taken in hand immediately. At a dosage of ¼oz. per day this will hardly be enough for 11 to 12 lakhs of the population. (The population of Calcutta alone is about 40 lakhs now).

4. Food Yeast can easily be introduced for civil consumption through Government channels to relieve malnutrition.

5. The Food Department should develop the use of Food Yeast as an anti-malnurition measure.

6. The manufacture of Food Yeast will help in the disposal of surplus molasses which instead of being wasted as at present, will be transformed into a rich food and will give nourishment to the poor population of this country.

7. The best site is at Jawalapur. Effluent disposal does not offer any problem as it can, with advantage, be discharged into a canal.

8 The first plant to manufacture 3 000 tons of Food Yeast should be owned by the Government. This plant, after successful operation for a year or two may be sold to any industrialist, if than the Government so desire.

9. It is estimated that India could easily consume about 1,00,000 tons of Food Yeast per annum. It should take about 8 to 10 years to attain this consumption if properly tackled. At the dosage of ¼ of an ounce this will be hardly enough for 40 million persons which is only one-tenth of India's peresent-day population.

10. The ownership of future plants will depend on the experience gained on this 3,000 ton plant.

11. The ways of incorporating

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APPENDIX I.

Acreages under Cane in the different Provinces and States.

Provinces.	1931-32	1932-33	1933-34	1934-35	1935-36	1936-37	1937-38	1938-39	1939-40	1940-41	1941-42	1942-43	1943-44
U. P. (Including Rampur).	1,593,000	1,793,000	1,734,000	1,840,000	2,249,000	2,515,000	2,222,000	1,652,000	1,909,000	2,539,000	1,745,000	1,897,000	2,192,000
Punjab ...	475,000	558,000	466,000	462,000	474,000	554,000	510,000	354,000	417,000	547,000	456,000	447,000	553,000
Bihar and Orissa	282,000	302,000	418,000	445,000	478,000	441,000	394,000	407,000	474,000	543,000	416,000	436,000	456,000
Bengal ...	233,000	233,000	257,000	276,000	325,000	355,000	290,000	299,000	316,000	331,000	314,000	303,000	339,000
Madras ...	117,000	125,000	120,000	122,000	119,000	122,000	178,000	98,000	138,000	162,000	112,000	122,000	148,000
Bombay and Sind	99,000	105,000	103,000	114 000	127,000	136,000	128,000	121,000	153,000	159,000	165,000	158 000	169,000
N.W.F.P. ...	44,000	53,000	49,000	43,000	59,000	71,000	70,000	51,000	71,000	96,000	85,000	77,000	90,000
Assam ...	31,000	32,000	35,000	35,000	37,000	40,000	39,000	38,000	38,000	41,000	40,000	44,000	45,000
C. P. and Berar	22,000	28,000	29,000	29,000	30,000	32,000	34,000	29,000	30,000	31,000	32,000	36,000	29,000
Delhi ...	3,000	4,000	3,000	8,000	3,000	5,000	6,000	1,000	1,000	3,000	2,000	2,000	3,000
Hyderabad ...	35,000	40,000	46,000	51,000	59,000	58,000	30,000	29 000	36,000	45,000	41,000	35,000	37,000
Mysore ...	36,000	42,000	42,000	46,000	51,000	52,000	50,000	45,000	49,000	51,000	46,000	42,000	40,000
Baroda ...	2,000	2,000	2,000	2,000	3,000	3,000	3,000	2,000	2,000	3,000	3,000	4,000	4,000
Bhopal ...	—	4,000	4,000	4,000	6,000	6,000	5,000	4,000	6,000	3,000	9,000	6,000	7,000
Miscellaneous Areas.	—	—	—	—	—	142,000	128,000	140,000	148,000	151,000	156,000	156,000	156,000
Total ...	2,972,000	3,321,000	3,308,000	3,477,000	4,020,000	4,582,000	3,987,000	3,270,000	3,788,000	4,710,000	3,622,000	3,755,000	4,268,000

APPENDIX II.

Yields of Cane in different Provinces in 1943-44.

Provinces.	Area under Sugar cane in 1943-44.	Yield of Cane 1943-44.	Yield of Cane per Acre.
1	2	3	4
	(Acres)	(Tons).	(Tons).
U. P. (including Rampur) ...	2,192,000	27,900,000	12.7
Punjab	553,000	5,730,000	10.4
Bihar and Orissa	456,000	5,380,000	11.8
Bengal	339,000	4,800,000	14.2
Madras	148,000	4,180,000	28.2
Bombay and Sind	169,000	5,290,000	31.3
N.W.F.P.	90,000	1,000,000	11.1
Assam	45,000	500,000	11.1
C. P. and Berar	29,000	430,000	14.8
Delhi	3,000	20,000	6.7
Hyderabad	37,000	800,000	21.6
Mysore	40,000	700,000	17.5
Baroda	4,000	160,000	40.0
Bhopal	7,000	50,000	7.1
Miscellaneous Areas	156,000	2,170,000	—
Total ...	4,268,000	59,110,000	13.8

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APPENDIX III.

Quantities of cane crushed by factories in the different Provinces (In Tons).

Provinces.	1931-32	1932-33	1933-34	1934-35	1935-36	1936-37	1937-38	1938-39	1939-40	1940-41	1941-42	1942-43	1943-44
United Provinces	851,000	1,641,000	3,015,000	3,685,000	5,533,000	6,304,000	5,786,000	3,505,000	7,034,000	5,199,800	3,877,000	6,028,000	7,332,400
Bihar ...	754,000	1,495,000	1,683,000	2,093,000	2,803,000	3,580,000	2,350,000	1,795,000	3,446,000	2,494,300	1,133,600	2.171,900	2,018,400
Orissa ...	179,000	214,000	459,000	—	—	232,000	16,000	9,000	27,000	34,200	31,800	21,100	17,600
Madras ...				160,000	191,000	—	218,000	246,000	343,000	482,000	352,300	291,000	420,400
Punjab, Sind and N.W.F.P.				67,000	113,000	164,000	139,000	87,000	175,000	242,700	215,700	129,600	174.200
Bombay ...				200,000	283,000	358,000	371,000	463,000	632,000	852,400	861,100	732,000	739,700
Bengal and Assam				141,000	295,000	280,000	222,000	131,000	430,000	611,300	313,600	199 600	175,900
States ...				204,000	668,000	770,000	814,000	768,000	1,024,000	1,374,200	1,241,200	845,300	1,259,200
	1,784,000	3,350,000	5,157,000	6,550,000	8,886,000	11,688,000	9.916,000	7,004,000	13,131,000	11,290,900	8,026,300	10,418,500	12,137,800
Burma ...	—	—	—	122,000	148,000	187,000	287,000	220,000	265,000	284,800	—	—	—

APPENDIX IV.

Average number of days of actual working in sugar factories in different Provinces.

		1932-33	1933-34	1934-35	1935-36	1936-37	1937-38	1938-39	1939-40	1940-41	1941-42	1942-43	1943-44
United Provinces	...	136	112	107	134	140	124	77	133	100	78	112	131
Bihar	...	149	105	109	124	150	99	79	136	100	54	96	93
Rest of India	...	112	84	90	112	125	103	97	119	144	117	89	110
India	...	138	106	104	126	138	112	63	129	113	85	101	117

APPENDIX IX.

Consumption and per capita consumption of sugar in the various Provinces & States (with population).

Provinces	1934-35.			1935-36.		
	Consumption. (Tons).	Population in (millions)	Per Capita consumption lbs.	Consumption. (Tons).	Population in (millions).	Per Capita consumption lbs.
Bengal	140,000	53·1	53·9	158,000	54·1	6·7
Bombay ...	243,000	24·5	18·0	212,000	24·9	15·5
Madras... ...	85.000	46·1	3·4	72.000	46·6	2·8
Bihar	57,000(a)	33·4	2·9(a)	62.000(a)	33·8	3·1(a)
U. P	124,000	51·1	5·4	131,000	51·9	5·6
Punjab	213,000(b)	29·8	13·5(b)	233,000(b)	30·4	14·6(b)
C. P. & Berar ...	40,000	15·6	4·8	40,000	15·7	5·1
Assam	11.000	9·3	2·5	14,000	9·5	3·5
Sind & Br. Baluchistan.	20,000	4·5	8·8	22,000	4·6	9·5
Orissa	(Included in Bihar)	8·2		(Included in Bihar	8·2	
N. W. F. P.	Included in Punjab	2·6		Included in Punjab)	2·6	
Delhi ...		0·7			0·7	
Rajputana ...	49,000	12·0	8·9	53,000	12·2	9·5
C. I.	26,000	10·4	5·5	28 000	10·5	6·1
Nizam's Territory ...	17,000	15·0	2·5	18,000	15·2	2·6
Mysore ...	5,000	6·7	1·5	8,000	6·7	2·6
Kashmir ...	2,000	3·6	1·5	2,000	3·6	1·2
Burma	27,000	...	3·9	21,000	...	3·1
All India ...	1.059,000	326·6	6·5	1,074,000	331·2	6·5

(a) Includes Orissa also.

(b) Includes N. W. F. P. and Delhi also.

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APPENDIX V.

Production of Sugar Directly from Cane in Modern Factories in India, 1930—1944.

Season.	Number of Factories Producing Sugar direct from Cane.	Cane Crushed.	Sugar Produced.
		(Tons)	(Tons)
1930-31	29	1,317,248	119,859
1931-32	32	1,783,499	158,581
1932-33	57	3,350,231	290,177
1933-34	112	5,157,373	453,965
1934-35	130	6,552,030	568,465
1935-36	137	9,885,748	919,100
1936-37	137	11,687,200	1,111,400
1937-38	136	9,916,400	930,700
1938-39	139	7,004,800	650,800
1939-40	145	13,131,700	1,241,700
1940-41	148	11,290,900	1,095,400
1941-42	150	8,026,300	778,100
1942-43	150	10,418,500	1,070,700
1943-44	151	12,137,800	1,216,400

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APPENDIX VI.

Quantities of sugar produced in the different Provinces. (In Tons)

Provinces.	1931-32	1932-33	1933-34	1934-35	1935-36	1936-37	1937-38	1938-39	1939-40	1940-41	1941-42	1942-43	1943-44
United Provinces	73,000	140,000	274,000	316,000	530,000	609,000	531,000	320,000	660,000	513,300	382,900	612,500	727,100
Bihar ...	68,000	129,000	140,000	184,000	250,000	329,000	225,000	162,000	322,000	246,100	117,300	237,400	212,400
Orissa ...				—	—	21,000	1,000	1,000	2,000	3,000	3,000	2,100	1,700
Madras ...				15,000	18,000	—	21,000	23,000	31,000	44,100	30,800	27,500	39,200
Punjab, Sind N.W.F.P.				4,000	9,000	15,000	12,000	7,000	15,000	21,800	19,200	11,800	17,400
Bombay ...	17,000	21,000	40,000	21,000	30,000	38,000	41,000	52,000	69,000	84,800	85,000	77,900	81,200
Bengal and Assam	—	—	—	11,000	24,000	24,000	20,000	10,000	40,000	52 000	23,700	16,500	13,600
States ...	—	—	—	18,000	58,000	75,000	80,000	76,000	103,000	130,300	116,200	85.000	123,800
Total ...	158,000	290,000	454,000	569,000	919,000	1,110,000	931,000	651,000	1,242,000	1,095,400	778,100	1,070,700	1,216,400
Burma ...	—	—	—	9,650	13,000	18,000	27.000	22,000	28,000	29,200	—	—	—

APPENDIX VII.

Recoveries of sugar and molasses per cent. cane.

Year	Recovery for U. P.		Recovery for Bihar.		Recovery for the rest of India.		Recovery for India as a whole.	
	Sugar.	Molasses.	Sugar.	Molasses.	Sugar.	Molasses.	Sugar.	Molasses.
1931-32 ...	8·59	3·87	9 06	3 88	9·60	3·90	8 89	3·89
1932-33 ...	8·55	3·93	8·60	3·87	8·90	3·72	8·66	3·89
1933-34 ...	9·08	3·65	8·32	3 63	8·75	4·20	8 80	3·69
1934-35 ...	8 56	3·41	8·79	3·43	8·77	4 08	8 66	3 50
1935-36 ...	9 30	3·30	8 93	3·47	9·00	3·91	9·29	3·44
1936-37 ...	9·65	3·30	9·2	3·73	9 00	3·59	9·50	3·48
1937-38 ...	9·18	3·58	9·58	3 39	9·77	3·53	9·38	3·53
1938-39 ...	9·14	3·47	9·00	3·31	9 91	3·59	9·29	3·46
1939-40 ...	9·37	3·67	9·29	3·62	9·84	3·85	9·45	3·69
1940-41 ...	9·87	3·64	9·86	3·74	9·34	3·94	9 70	3·76
1941-42 ...	9·87	3·37	10·35	3·30	9·22	4·14	9·69	3·65
1942-33 ...	10·16	3·52	10·93	3 42	9·95	3·71	10·28	3·54
1943-44 ...	9 92	3·58	10 53	3 39	9 94	3·87	10·02	3·61

APPENDIX VIII.

Table showing quantity of Molasses produced in the different Provinces in India during the last ten years.

Provinces.	1934-35.	1935-36.	1936-37.	1937-38.	1938-39.	1939-40.	1940-41.	1941-42.	1942-43.	1943-44.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
U. P.	126,000	183,000	208,000	207,000	122,000	258,000	189,300	130,700	212,300	262,600
Bihar Orissa	72,000	97,000	134,000	80,000	60,000	126,000	93,500	37,400	74,400	68,300
			10,000	1,000	...	1,000	1,600	1,500	900	800
Madras	7,000	8,000		8,000	9,000	15,000	20,700	16,600	11,300	17,900
Punjab, Sind and N.W.F. Provinces.	3,000	5,000	5,000	5,000	3,000	7,000	10,100	7,400	4,500	5,500
Bombay	7,000	10,000	12,000	13,000	15,000	24:000	35,400	38,600	28,600	28,700
Bengal and Assam ...	5,000	11,000	10,000	7,000	4,000	16,000	26,100	12,700	6,600	8,200
States	8,000	17,000	28 000	29,000	29 000	38,000	47,900	48,000	30,500	46,700
Total ...	228,000	331,000	407,000	350,000	242,000	485,000	424,600	292,900	369,100	438,700
Burma	5,000	7,000	8,000	11,000	7,000	9,000	9,300			

APPENDIX IX—*contd.*

Provinces.	1936-37.			1937-38		
	Consumption. (Tons).	Population in (m illions)	Per Capita consumption. lbs.	Consumption. (Tons).	Population in (million)	Per Capita consumption lbs.
Bengal	174,000	55·1	7·3	190,000	56·1	7·9
Bombay ...	223,000	25·3	16·2	230 000	25·7	16·3
Madras... ...	100,000	47·1	3·9	100,000	47·6	3·9
Bihar	70,000(a)	34·2	3·5(a)	58,000(a)	34·6	3·3(a)
U. P.	125.000	52·5	5·4	150,000	53·1	6·4
Punjab	265,000(b)	31·0	16·5(b)	206,000	31·6	14·9
C. P. & Berar ...	43,000	15·8	4·9	44,000	6·9	5·0
Assam	17,000	9·7	3·6	18,000	9·8	4·0
Sind & Br. Baluchistan.	25,000	4·7	10·2	30,000	4·7	12·6
Orissa	...	8·3	...	3,000	8·3	...
N. W. F. P.	...	2·7	...	22,000	2·7	10·5
	Included	in	Punjab			
Delhi ...	...	0·7	...	10,000	0·8	30·3
Rajputana ...	58 000	12·4	10·6	43,000	12·6	9·9
C. I.	35.000	10·7	6·4	23,000	10·8	4·5
Nizam's Territory ...	19,000	15·4	2·7	21,000	15·5	3·0
Mysore	10.000	6·8	2·9	4,000	6·9	1·3
Kashmir ...	3,000	3·7	1·7	2,000	3·7	1·2
Burma	...	...	...	...	..	...
All India ..	1,167,000	335·1	7·3	1,159,000	340·6	7·2

(a) Includes Orissa also. (b) Includes N. W. F. P. and Delhi also.

APPENDIX XX

Statement showing the proposed location of mixing depots for the mixing of power alcohol with petrol.

Note. The situation of the Depots is shown in columns (1).
The present average monthly throughout of petrol is shown in columns (2).

Burmah-Shell Depots.		Standard Vacuum Depots.		Caltex Depots.		I. B. P. Depots.	
1	2	1	2	1	2	1	2
1. CALCUTTA AREA							
Budge Budge	15,100	Chittraganj	13,885	Calcutta	155 824	Kalighat	128,492
Kalighat	204,100	Chetla	281 697	Allahabad	4,540	Budge Budge	'598
Narculdanga	215,800	Fort Gloster	333	Asansol	4,164		
Asansol	29 800			Benares	8,524	Lucknow	16,583
Azamgarh	5,200	Agra	10,722	Gaya	3,605		
Bankura	3,700	Allahabad	13,557				
Benares	21,700	Asansol	14,796				
Berhampore	15,200	Bareilly	13,097				
Bhagalpur	12,800	Benares	10,823				
Bilaspur	3,600	Cawnpore	24,345				
Burdwan	4,100	Cuttack	4,308				
		Dhanbad	14,201				
Chakradharpur	15,100	Gauhati	28,611				
Chaibassa	7,900	Gaya	5,472				
Cuttack	14,800	Gorakhpur	4,5[illegible]4				
Dacca	8,000	Kharagpur	3,943				
Dhanbad	17,400	Lucknow	14,336				
Gaya	19,000	Ratna	9,989				
Giridih	9,200	Raipur	4,770				
Gondia	5,400	Sarak	6,466				
Hazaribagh	10,100	Siliguri	3,507				
Jessore	4,500	Tatanagar	17,282				
Kharagpur	8 700	Dum Dum	197				
Kodarma	2,300						
M l Junc.	13,700						
Mirzapore	2,400						
Monghyr	3,200						
Muzaffarpur	28,800						
Patna	27 500						
Purulia	4.490						
Raipur	24,100						
Rampurhat	10,400						
Ranchi	22 900						
Raxaul	13,800						
Sambalpur	5,400						
Santahar	18 400						
Seoni	2,800						
Siliguri	24,700						
Tatanagar	29.600						
2. DELHI AREA							
Agra	31,400	Delhi	73,670	Delhi	67,931		
Aligarh	17,300	Etwah	4,874				
Allahabad	19 400	Hathras	11,167				
Bareilly	21 700	Jodhpur	8,030				
Basti	7,800	Jullundur	21,030				
Cawnpore	30,000	Lahore	63,700				
Delhi	135,800	Multan	36,500				

APPENDIX IX—*contd.*

Provinces.	1938-39. Consumption (Tons).	1938-39. Population in (million)	1938-39. Per Capita consumption lbs.	1939-40. Consumption. (Tons).	1939-40. Population in (million)	1939-40. Per Capita consumption lbs.
Bengal	139,000	57·1	5·8	161,000	58·2	6·7
Bombay ...	244,000	26·2	17·0	219,000	26·6	15·2
Madras	88,000	48·2	3 4	94,000	48 7	3 6
Bihar	50,000	35·0	2·8(a)	57,000	35 4	3·1(a)
U. P.	170,000	53 7	7·1	153,000	54·3	6·3
Punjab	164,000	32 2	11·8	169,000	32·8	12 0
C. P. & Berar ...	37,000	16·2	4·2	38,000	16·4	4·3
Assam	19,000	9.9	4·1	16,000	10·0	3·5
Sind & Br. Baluchistan.	34,000	4·8	14·1	35,000	4·9	14·3
Orissa	8,000	8·4	...	8,000	8·5	...
N. W. F. P. ...	13,000	2·8	6·2	8,000	2·8	3 8
Delhi	16,000	0·8	44·8	20,000	0·8	44·8
Rajputana ...	37,000	12·8	6·7	38,000	13·1	6·8
C. I.	24,000	11·0	4·6	25,000	11·2	4·8
Nizam's territory ...	19,000	15·8	2·7	20,000	16·0	2·8
Mysore... ...	8,000	7·0	2·6	11,000	7·1	3·5
Kashmir ...	3,000	3·7	1·7	2,000	3·8	1·1
Burma	...	...	...	...	...	...
All India ...	1,073,000	345·6	6·6	1,074,000	350·6	6·5

(a) Includes Orissa also.

(b) Includes N. W. F. P. and Delhi also.

APPENDIX IX—*concld.*

Provinces.	1940-41. Consumption. (Tons).	Population in (million)	Per Capita consumption lbs.	1941-42. Consumption. (Tons).	Population in (million)	Per Capita consumption lbs.
Bengal	178,000	59·3	6·6	120,000	60·3	4·5
Bombay ...	260,000	27·4	20·8	240,000	27·9	19·2
Madras... ...	106,000	49·2	4·8	90,000	49·7	4·1
Bihar	69,000	35·8	3·9(a)	66,000	36·3	3·6(a)
U. P.	244,000	35·1	9·8	159,000	55·9	6·4
Punjab ...	231,000	33·4	15·3	199,000	34·0	13·1
C. P. & Berar ...	47,000	16·6	6·3	37,000	16·8	4·9
Assam	20,000	10·1	4·4	11,000	10·2	2·4
Sind & Br. Baluchistan.	44,000	4·9	19·5	39,000	5·0	17·3
Orissa	10,000	8·6	...	7,000	8·7	...
N. W. F. P. ...	18,000	2·9	13·8	15,000	3·0	11·1
Delhi	22,000	0·9	53·7	14,000	0·9	34·2
Rajputana ...	48,000	13·3	7·9	60,000	13·6	9·8
C. I.	35,000	11·3	6·8	33,000	11·5	6·4
Nizam's territory ...	27,000	16·2	3·7	23,000	16·3	3·2
Mysore... ...	14,000	7·2	4·3	15,000	7·3	4·6
Kashmir ...	3,000	3·8	1·7	4,000	3·9	2·3
Burma	...	...	...	...	...	...
All India ...	1,376,000	356·0	8·5	1,132,000	361·3	7·0

(a) Includes Orissa also.

(b) Includes N. W. F. P. and Delhi also.

APPENDIX X.

Quantity of sugar exported from Java.

Destination.	1940-41.	1939-40	1938-39.	1937-38.
	Tons.	Tons.	Tons	Tons.
Near & Middle East :—				
Arabia	4,428	8,617	5,941	648
Aden	2,837	16,406	14,124	10,791
Iraq	18,711	24,353	12,202	8'091
Iran	38,247	63,243	,460	...
Somali Land	203	305	127	...
British East Africa	1,166	3,067	3,766	3,135
Port. East Africa	533	1,208	937	862
Colombo	61,056	88,162	69,670	68,156
Total ...	127,181	205,361	1,117,227	91,633
Far East :—				
Burma	203	6,518	1,840	...
Siam	18,704	16,927	23,354	22,257
British Malaya	732	313	...	3
Penang	21,596	19,280	18,160	21,616
Singapore	75,817	72,416	63,166	68,535
Fr. Indo China	558	786	1,975	1,852
Hongkong	165,188	113,938	122,179	90,502
China	78,319	22 094	19,967	33,300
Br. N. Borneo	3	174	...	...
Sarawak	537	1,237	...	...
Total ...	361,657	253,683	250,641	238,065

APPENDIX XXII.

Summary of Report of the Power Alcohol Committee of the Inquiry, Australia, 1941

Introduction.—

For strategic reasons, and in view of the possible depletion of petroleum resources, there is world-wide interest in such substitute fuels as petrol from coal and shale, power alcohol, benzol, charcoal, producer gas and coal gas.

Anhydrous ethyl alcohol may be manufactured from sugary, starchy or cellulosic materials. As power alcohol it is most commonly used in 12½ per cent. to 20 per cent. blends with petrol.

Power Alcohol Production in other Countries.

The world production of power alcohol approximates to 200,000,000 gallons, distributed among some dozen countries. In most countries, where power alcohol is used, there is legislation to enforce its use; this is necessary owing to the higher price of alcohol than of petrol.

Power Alcohol Production in Australia.—

Anhydrous alcohol for use as a motor fuel has been produced in Australia since 1925, though it is only recently that the total annual production has exceeded 1,000,000 gallons. The use of power alcohol has been covered by State legislation in Queensland (1933), and in New South Wales—(1941).

The total present normal capacity of distilleries engaged in the power alcohol industry is 5,000,000 gallons per annum. Owing to shortage of raw material (molasses) the distilleries have not worked hitherto to full capacity. It is estimated that there is in addition, suitable distillery capacity in Australia for some 5,000,000 gallons of 95 per cent alcohol.

Methods of Production —

The process of manufacturing anhydrous alcohol from sugary susbtances comprises (a) fermentation by yeast to produce a liquid containing 10 per cent alcohol and (b) distillation of the fermented liquor and dehydration by a patented process.

Starchy substances must first be treated by malting, hydrolysis with acid, or the action of moulds (amylo process) to break the starch down to sugar. Subsequent fermentation and distillation are much the same as for sugary substances.

Cellulosic substances (*e. g.*, wood) may be converted to sugar by two processes, both involving the action of acid on wood.

General by-Products. -

There is no immediate prospect of an additional financial return from the recovery of the by-products common to all fermentation processes carbon dioxide, fuel oil, and yeast.

Value as Motor Fuel.—

Alcohol containing water is unsatisfactory as a mortor fuel unless considerable quantities of a blending agent are added. Discussion in the Report is based on the use of anhydrous alcohol in 12½ to 20 per cent. blends with petrol.

There is ample evidence that alcohol-petrol blends in the proportions named possess all the properties desirable in a motor fuel. Evidence indicates that there is no measurable difference as between a 15 per cent. alcohol-petrol blend and other super fuels in mileage per gallon, and in other criteria of performance

The addition of 1 per cent. of alcohol to petrol raises the octane rating by about 0·6 unit A higher octane rating over that of standard grade petrol is desirable for many modern cars and is likely to increase in importance as engine design changes.

Before the war, super-grade (75-78 octane) fuels in Australia were obtained by:

(a) importing high octane petrol;

(b) adding tetra-ethyl-lead to standard grade (70 octane) petrols;

(c) adding anhydrous alcohol to standard grade petrol.

Government measures since the war began have excluded the first two methods.

Alcohol may be assigned on "additive value" in excess of the value of an equal volume of petrol, by reason of its power to raise a standard grade fuel to a "super" grade, when blended in the correct proportions. The level of this "additive value" depends upon the assumptions on which the calculation is made, and can range from 2d. to 7½d. per gallon alcohol.

APPENDIX XI.

Factories with capacities below 800 tons per day.

Factory.	Capacity (Tons per day).
N. W. F. P. :—	
Takhati-Bhai	400–500
Punjab :—	
Pattoki	100
Rahwali	300—450
Abdullapur	400
United Provinces :—	
Doiwala	520
Saknotitanda	717
Meerut	650
Mohiuddinpur	750
Muradnagar	60
Kichha	750
Kashipur	600
Amroha	500
Aira	650
Rosa	725
Burhwal	650
Aishbagh	793
Nawabganj (Experimental)	28
Balrampur	700
Katra	100
Babhnan	793
Tulsipur	700
Walterganj	700—800
Basti	760
Kunderwa	700
Khalilabad	650
Khadda	761
Ledi	90
Siswabazar	620
Pipraich (Diamond)	778
Gauribazar	650
Pipraich	213
Tahsil Deoria	351
Bhatni	720
Lakshmiganj	700
Ramkola	777
Kathkuiyan	400
Purtabpur	750
Jhusi	400
Shahganj	750
Naini	250
Bihar :—	
Pakri	500—600
Motihari	783
Bagaha	450
Sasamusa	750
Siwan	700
Mahrajganj	400
Sidhwalia	650
Samastipur	700
Ryam	700
Sakri	700
Buxar	100
Bikramganj	600
Orissa :—	
Aska	120
Rayaghada	200
Bengal :—	
Bochaganj	750
Plassey	500
Shomeganj	150
Charisindur	300
Belacoba	150
Kishoreganj	300—350
Bhowanipur	75
Assam :—	
Deopani	50
Madras :—	
Thummapala	200
Etikopaka	65
Bobbili	150
Seethanagram	300
Kirlampudi	100
Hospet	500
Podanur	50
Mangalore	60
Mailpatti	75 - 100
Pugalur	250
Bombay :—	
Akluj	400
Ravalgaon	600
Belvandi	250—300
Sakrvadi	650
Puntamba	850
Lakshmiwadi	600
Boregaon	350
Sind :—	
Mohattanagar	500
Indian States :—	
Phagwara (Kapurthala State)	700
Kolhapur	450
Gandevi (Baroda State)	280
Sakarwadi (Phalton State)	650
Jaora	550
Sehore (Bhopal)	758
Karera (Udaipur)	300
Harpalpur	100
Dubra (Gwalior)	700
Mahidpur Rd. (Holkar)	250—300
Uggr Khurd (Belgam)	500
Ranbir Singhpur (Jammu State).	500
Kittur	150

Transport.—

Technical difficulties in the transport of alcohol in drums or in road or rail tanks have been overcome.

There is no experience of the transport of large quantities of anhydrous alcohol in tanker ships. The chief technical difficulty is to avoid absorption of water; this difficulty would have to be overcome before alcohol could be successfully transported by sea in bulk.

Estimates were prepared for the Committee, of the cost of transporting alcohol from Queensland ports to Sydney and Melbourne in a 1,300-ton vessel designed to carry 420,000 gallons. The estimate of transport costs for 6,000,000 gallons per annum amounts to 2·39d. per gallon, exclusive of delivery to and from the ship; an estimate of the total transport cost from a Queensland distillery 20 miles in and, to blenders' depots in Melbourne and Sydney, amounts to 3½d. per gallon.

Denaturation.—

Power alcohol may be denatured as for mineralized spirits *i. e.* by adding ¼ per cent. methyl alcohol, 1/20 per cent. pyridine and 2 per cent. petrol A more suitable denaturation, for use only under security to the Customs Department, is ¼ per cent. methyl alcohol and 5 per cent. petrol.

The present cost of denaturing power alcohol is between 0·4d. and 0·8d per gallon, according to locality.

Royalties.—

Royalties at rates of about ½d. per gallon are payable on patents covering the process of producing anhydrous alcohol.

Sugar.—

A brief review is given of the history of the sugar industry in so far as it bears on the Terms of Reference of the Committee From a survey of the present position of the industry in Queensland it is concluded that (a) the average price of cane as sold to the mill-owner is about 32s. per ton; (b) the home consumption price of raw sugar is approximately £23·10s per ton; and (c) the export price has varied from about £8 per ton pre-war to about £11 per ton at present The average price of home consumption and export sugar together is about £15 10s. per ton The present positions in New South Wales for sugar-cane, and in Victoria for sugar beet are described.

In 1940, over 50 per cent. of Queensland molasses was sold to distilleries; this percentage is expected to rise to approximately 75 per cent. in 1941. The usual price is 15s per ton at mill. Only a negligible quantity of molasses is run to waste Whatever be done, no further significant increase in power alcohol production from molasses can be expected.

In the process of milling, sugar-cane is crushed to produce a juice which is clarified. In a series of four stages the clarified juice is crystallized, and the sugar crystals are separated from there corresponding syrups by centrifuging. After the last crystallisation there remains the molasses.

After examining several schemes whereby sugar might be diverted during manufacture to supply a raw material for alcohol production, the Committee considers that a "juice mill" scheme would be more satisfactory than the other schemes it examined. In this scheme a distillery operates on clarified juice from some 250,000 tons of cane being the entire crop consumption at one large mill. If it were agreed that a price of £7·9s. at mill per ton of 94 net titre sugar and corresponding malasses, both in the form of clarified juice were so be paid (approximately equivalent to about £9 per ton 94 net titre sugar f. o. b. Queensland port) then the alcohol could be sold in capital city at 2s. per gallon wholesale

Each 1,000 000 gallons of alcohol produced from sugar-cane would absorb about 50,000 tons of cane, or 8,000 tons of sugar.

Wheat —

A review of the position of the wheat industry leads to the conclusion that after the present year (1941), there will be difficulty in disposing of Australia's war-time surplus of wheat.

The average price per bushel f o. r. Williamstown (Victoria) over the years 1921-1939 is 3s. 2d. The view was expressed that the lowest price likely to be accepted for wheat as a raw material for alcohol in 3s.6d. per bushel f o r., this corresponds to a price for alcohol of about 2s. per gallon by the malting process According to the 1935 Royal Commission, a price of 3s. 6d. a bushel would return costs to only about half the wheat farmers of Australia. On the present fixed return to growers of 3s. 10½d f.o.r. port the price of alcohol would be approximately 2s. per gallon by the amylo process. Of the two processes, malting is the better known.

INDIAN STATES *Contd*:—

Serial No:	Name of Factory	Location	Daily cane crushing capacity (Tons:)	Remarks:
DECCAN STATES.—				
5.	The Kolhapur Sugar Mills ...	Kolhapur.	500	
6.	The Ugar Sugar Works Ltd. ...	Ugarkhurd.	500	
7.	Krishna Sugar Mills Ltd. (Kudchi)	Miraj Jr. State.	—	
8.	The Phalton Sugar Works Ltd. ...	Miraj (Sakharwadi)	625-650	
C. I. STATES —				
9.	Bhopal State Sugar Industries ...	Seohore	750	
10	The Jaora Sugar Mills ...	Jaora.	450-606	
11.	The Gwalior Sugar Co. Ltd. ...	Dabra.	750	
12.	Seth Govindram Sugar Works ...	Mahidpur Road.	—	
HYDERABAD STATE —				
13.	The Nizam Sugar Factory Ltd. ...	Bodhan.	1300-1500	
RAJPUTANA:—				
14.	The Mewar Sugar Works Ltd. ...	Kareta:	300	
JAMMU & KASHMIR:—				
15.	Shree Yuvraj Jammu Kashmir Sugar Mills Ltd: ...	Ranbirsinghpura	—	
MYSORE:—				
16.	Mysore Sugar Co: Ltd: ...	Mandya.	1400	
TRAVANCORE:—				
17:	The Travancore Sugar and Chemicals Ltd.	Thauklay:	(Gur only) 18	
	INDIAN STATES	...	10543-11524	

सत्यमेव जयते

Burmah-Shell Depots.		Standard Vacuum Depots.		Caltex Depots.		I.B.P. Depots.	
1	2	1	2	1	2	1	2
2. DELHI AREA.—*contd.*							
Alwar	7,100	Peshawar	64.700				
Etwa	5,700	Rawalpindi	32 800				
Fyzabad	1,900	Saharanpur	19,500				
Gorakhpore	10,900						
Gwalior	10.000						
Jaipur	28,900						
Jhansa	11,100						
Kathgodam	18,000						
Lucknow	30,000						
Meerut	40 900						
Mohaba	6,700						
Moradabad	6.700						
Muttra	8,100						
Muzaffarnagar	5,500						
Protabgarh	10,400						
Rohtak	17,500						
Satna	6,000						
Shajehanpur	1,100						
3. KARACHI AREA							
Karachi	74,000	Karachi ex Keamari	84,000	Karachi	77,041		
Morgah	81,200			Agra	3,615		
Ambala	12,700			Ambala	1,878		
Amritsar	24,900	Amballa M.P.I.	27,200	Lahore	88,428		
Bannu	26,300			Lucknow	16.902		
Batala	6 700	Amritsar	28,800	Rawalpindi	42,257		
Chaman	27,000	Sargodha	12 780				
Dehradun	16,100	Wazirabad	18,000				
Ferozepur	37 000						
Gujranwala	20,400						
Havelian	15 800						
Hoshiarpur	10,400						
Hyderabad	33,600						
Jammu	38,600						
Jodhpur	20,300						
Jullundur	22,900						
Kalka	10,700						
Karnal	7,100						
Kohat	17,200						
Lahore	100,100						
Larkana	20,100						
Ludhiana	15,700						
Lyallpur	35,600						
Montgomery	33,700						
Moga	11,700						
Multan	34 100						
Nowshera	27 200						
Patiala	13,200						
Pathankote	26,500						
Peshawar	82 100						
Quetta	40,500						
Saharanpur	18,200						
Sargodha	18 500						
Sialkote	15,400						
Tank	8,700						

Burmah-shell Depots.		Standard Vacuum Depots.		Caltex Depots.		I. B. P. Depots.	
1	2	1	2	1	2	1	2
4. BOMBAY AREA.							
Bombay	473,900	Wadala	225,836	Bombay	221.107	Wadala	81,881
Marmugoa	34,500	Ahmednagar	11,768	Ahmedabad	28 096		
Ratnagiri	9.900	Akola	10,115	Nagpur	21,081		
Karwar	3.600	Amraoti	11.352	Poona	46,953		
Chipleon	8,300	Asarwa	45,180	Rutlam	752		
Coondapur	1,300	Baroda	9,446	Secunderabad	14,777		
Kumta	4,100	Belgaum	13,982				
Ahmednagar	19,400	Bhopal	7 258	Sholapur	6,355		
Akola	16,000	Dhulia	3,888				
Amraoti	16 200	Hubli	18,122				
Bhopal	13,400	Jalgaon	3,834				
Dhulia	11,600	Jhansi	7,684				
Dhamangaon	8,100	Jubbulpore	11,778				
Gulberga	5,300	Kolhapur	17,449				
Jalgaon	17 200	Manmad	...				
Jubbulpore	18,200	Marmugoa	5,975				
Khamgaon	12,600	Nadiad	9,111				
Khandwa	12,400	Nagpur	23,772				
Karjet	8,800	Nasik Rd.	22,439				
Manmad	16,600	Poona	43,923				
Aurangabad	4,600	Rutlam	7,216				
Jalna	1,600	Satara	15,384				
Murtizapur	4 300	Secunderbbad	46,417				
Nagpur	36,800	Shimoga	6,474				
Nasik	30,000	Sholapur	3,220				
Poona	97,100	Surat	8 811				
Belgaum	30,300	Udipi	7,533				
Dharwar	8,200						
Gadag	11,400						
Hubli	18,100						
Kolhapur	40,500						
Lonand	13,100						
Sangli	22,800						
Satara	17,000						
Sholapur	24,700						
Bagalkot	6,700						
Bijapur	9,100						
Wardha	5,100						
Baroda	35,200						
Broach	3,400						
Nadiad	15.300						
Navsari	6,300						
Rutlam	23,000						
Indore	37,100						
Surat	28,300						
Ujjain	5,700						
Kotah	9,500						
Saugor	9,100						
Godhra	5,200						
Okha	16 900						
Morvi	17,500						
Ahmedabad	117,900						
Ajmer	22,200						
Udaipur	5,800						
Bellary	11,200						
Birur	8,300						
Chitaldroog	6,400						
Hassan	9,300						
Shimoga	15,600						

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Burmah-shell Depots		Standard Vaccum Depots		Caltex Depots		I. B. P. Depots	
1	2	1	2	1	2	1	2
5. MADRAS AREA.							
Tondiarpet	143 300	Madras	99,9[illegible]0	Madras	89,264	—	
Cocanada	13,100	Bangalore	53 750	Bangalore	14,708		
Ernakulam	34,700	Bezwada	22,732	Guntakal	3,904		
Bangalore	122,600	Bellary	5,757	Trichinopoly.	11,743		
Bezwada	34 300	Calicut	16,[illegible]78				
Bowringpet	15,200	Coimbatore	10,419				
Calicut	21,600	Cuddapah	11.835				
Chicacole Road.	4,900	Dinigul	14,630				
Coimbatore	28,400	Guntur	9,782				
Cuddalore	11,800	Karaikudi	14,776				
Cuddapah	22,900	Katpadi	21,1[illegible]6				
Dindigul	12,900	Madura	27.862				
Erode	11,300	Mangalore	8 990				
Guntur	28,700	Mettupalayam	19,015				
Kåraikudi	16,100	Mysore	15,783				
Katpadi	51,600	Pudukottah	16 773				
Kottayam	33,900	Salem	21.550				
Kumbakonam	14,900	Tindivanam	1,198				
Kurnool	7,100	Tinnevelly	8,604				
Madura	35,000	Trichinopoly.	30,475				
Mangalore	27,500						
Mayavaram	5 200						
Mettupalayam	36 900						
Mysore	22,000						
Nandyal	1,800						
Nellore	28.900						
Nidadavole	13,400						
Nizamabad	5,300						
Nuzvid	17,100						
Ootacamund	3 400						
Palghat	46,200						
Pollachi	22,300						
Pudukottah	10,300						
Quilon	159,300						
Raichur	3,700						
Rajahmundry	9,200						
Salem	31,400						
Salur	9,800						
Sattur	18,300						
Secunderabad.	123,900						
Tadepalligudem.	3,300						
Tanjore	9,400						
Tellicherry	30.500						
Tindivanam	10,200						
Tinnevelly	19,700						
Tiruppur	14 500						
Tiruvannamalai	6,200						
Tiruvarur	8,200						
Trichinopoly	20,200						
Trichur	24 600						
Trivandrum	28,900						
Tuticorin	6.600						
Vizianagram	8,100						
Waltair	20,300						
Warangal	9.300						
Wellington	17,700						

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APPENDIX XXI

Alcohol as motor fuel : Technical considerations.

It has been established long ago that alcohol either neat or mixed with petrol, could be used as fuel for internal combustion engines. The chief drawbacks against its use are that alcohol has lower vapour pressure lower calorific value and higher specific gravity as compared with petrol. It is also hygroscopic in character and therefore absorbs moisture from the air.

2. For the use of alcohol, unmixed with petrol, drastic alterations to the carburettor system are necessary, and alcohol cannot be used as an alternative fuel to petrol for the same engine without extensive adjustments. Owing to the lower air to fuel ratio necessary for satisfatory engine operation when using neat alcohols as compared with operation on petrol and also the lower calorific value of alcohol satisfactory acceleration, power out ut, general running and fuel economy can only be attained by increasing the sizes of the carburettor jets to sizes up to approximately 1 5 times larger than those used in the case of petrol At the same time, owing to the difference in specific gravities the carburettor float requires to be proportionately weighed to maintain the fuel level at the jets The lower vapour pressure of alcohol leads to difficulties regarding starting of the engine from cold. Improvement in this respect would require the fitting of heating devices to the carburettor and induction manifold. Engines running on alcohol unmixed with petrol, in order to be efficient, must employ higher compression. Such engines have to be specially designed If the carburettor system of a commercial motor engine of the usual type is altered to make it suitable for use with alcohol, it would not be able to run on petrol without inconvenient readjustments of its carburettor. Thus, it is only possible to run on alcohol fuel, when the user is sure of getting continuous supply of the material. Such conditions would apply to a user whose service is within a limited radius of the supply base, for instance, local suburban bus services etc. The above is true whether power alcohol is used or rectified spirit.

3. A characteristic of rectified spirit is that whilst it is capable of remaining as a mixture when mixed with 50 per cent petrol or less, it is liable to separate out when the amount of petrol exceeds 50 per cent In any mixture conisting of 50 per cent. rectified spirit or more with petrol the conditions mentioned in the paragraph above for unmixed alcohol apply, but only to a limited extent. It may be poesible to run the engine with out a special heating device and the jet enlargement of the carburettor need not be as large as in the case of unmixed alcohol. The alteration in the flow level need not also be so great. Thus, it would be possible to run the same engine on straight petrol without adjustments although petrol consumption would be higher than when the carburettor was properly abjusted for petrol. It is possible, therefore, to employ 50/50 mixture of alcohol and petrol without appreciable inconvenience so long as there is a reasonable certainty of obtaining the fuel. This can be assured by arranging the marketing of a certain amount of 50/50 fuel in a certain district or area.

4 The great advantage of power alcohol is that it is fully mixable with petrol up to a mixture of 25 per cent alcohol and 75 per cent petrol. For such mixtures, containing up to 20 per cent. of alcohol, there is no difference in behaviour with that of neat petrol. No carburettor adjustments are required and a motor vehicle can, therefore, run indiscriminately on neat petrol or this mixture. In a mixture of 20 per cent absolute alcohol and 80 per cent petrol, the higher latent heat of alcohol becomes an important factor. Although alcohol has lower calorific value, the effectiveness of a mixture of 20 per cent. alcohol and 80 per cent petrol is the same as that of ordinary petrol and the consumption of the mixed fuel per gallon is also practically the same

5 A 20 per cent power alcohol and 80 per cent petrol mixture does not show any tendency for seperation of alcohol and petrol at temperatures such as are likely to be met with in this country. Also, there is no danger what soever of such a mixture separating out on account of absorption of water by alcohol owing to the hygroscopic property of the latter.

If the work be placed sufficiently high in the defence priority list, a single juice mill distillery of 5,000,000 gallons annual capacity could be completed in from 12 to 18 months, and a wheat distillery of the same size in 24 months.

The number of men and quantity of material required in the design, fabrication and erection of one 5,000,000 gallon distillery, costing about £500 000 are given.

Organization and control production.

In order to ensure financial stability to a permanent power alcohol industry, it may prove necessary for the Government to guarantee both capital and profits; an alternative would be joint investment of capital by Commonwealth and/or State Government, and private interests.

Governmental control of production would be assured by either of the above methods. Control of production could alternatively be exercised by State Government prohibiting the erection of distilleries in their territories except under licence.

If new distilleries be erected by the Government as a war-time emergency measure, they should be operated for a period of 5 years, and their future then determined in the light of conditions then ruling.

To facilitate that decision, the Government should institute enquiries into several matters set out.

Marketing.

Some legislative control is necessary for the successful marketing of power alcohol, to ensure :—

(a) the sale of all alcohol of which the selling price is reasonable;

(b) that the benefits of alcohol as a blend with petrol are not lost by the use of unsuitable proportions of alcohol in the blend;

(c) that alcohol-petrol blends of suitable quality are sold under distinctive names as super fuel.

During the war, regulations under the National Security Act 1939-40 would ensure the marketing of suitable blends. After the war, marketing could be controlled either by State legislation (as in Queensland at present and as proposed in New South Wales) or under the Customs Act 1901-1936.

Matters requiring further investigation.

Any permanent development of the power alcohol industry should be accompanied by technical research, examples of which are given; the type of organization necessary to conduct such investigations is outlined.

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Conclusions

The Committee considers it established that anhydrous alcohol is entirely saisfactory as a motor fuel when blended with petrol in proportions between 12½ pert cent. and 20 per cent. Alcohol, to be used for blending, has a value in excess of the value of an equal volume of standard petrol, by reason of its power to raise a standard grade fuel to super grade. Maximum benefits are obtained with 15 per cent. of alcohol, and the Committee considers that alcohol should be blended in this percentage, and the blend marketed through the established channels for petrol distribution under distinctive name indicating the presene of alcohol. The norma consumption of petrol in Australia is about 350,000,000 gallons per annum; if this quantity were in the form of a 15 per cent. alcohol blend, 52,500,000 gallons of alcohol would be required.

The three existing power alcohol distilleries in Australia, if operating continuously and using raw sugar to supplement their raw material, molasses, could produce about 7,000,000 gallons of power alcohol. On this basis, Australia could absorb production from new distilleries of a total annual capacity of 45,500,000 gallons of anhydrous alcohol. Production could be brought to this level by building new distilleries suitably distriuted through the Commonwealth. The Committee makes no recommendation as to the distribution of distilleries between wheat and sugar; one possible distribution discussed in the Report is 38,000,000 gallons from wheat and 7,500,000 gallons from sugar. By this distribution each State except Tasmania, which has no suitable raw material, would produce 15 to 20 per cent. of its liquid fuel requirements, and the industry could use about 15 per cent of the normal exportable quantities of wheat and sugar. If placed sufficiently high in the defence priority list for supply of material and skilled tradesmen all the distilleries could be completed in about two years. For one distillery of 5,000,000 gallons annual capacity, about 150 tons of copper and 1,500 tons of iron and steel would be required; also some 160 skilled tradesmen and about 150 unskilled workmen.

In these estimates, allowance for revenue from by-products has been made only for the value of fodder.

Each 1 000,000 gallons of alcohol, produced by the malting process would absorb about 435,000 bushels of wheat

Unless some pooling system for the selling of wheat persists after the war, or unless an arrangement is made by the Government for the purchase of wheat for alcohol production, there can be no assured supply of wheat in adequate quantity and at a stable price.

Wood.—

Tasmanian proposals for the production of alcohol from wood were examined. The process of converting wood into alcohol has not been carried out in Australia, even on an experimental scale. Consequently little confidence can be placed in present estimates of the cost. Tentative estimates point to a likely cost of about 2s. per gallon of alcohol.

Wood is probably the cheapest potential raw material for alcohol in Australia. With proper management, forests could be used for this purpose without their becoming exhausted.

Much time would be required and expense involved before the most suitable process (the Scholler process) could be successfully applied in Australia. The Committee recommends that research should be undertaken into the technology of the process.

Other materials.—

Apples and Pears.—Owing to the loss of overseas markets, there is likely to be annual war-time surplus of some 65,000 tons of apples and 11,000 tons of pears; these together are a potential source of some 975,000 gallons of alcohol.

Apples and pears are unsuitable as raw materials for alcohol because (a) their cost would be too high even at the lowest possible price (40 s. per ton including collection costs, equivalent to 3s. per gallon of alcohol for raw material only); (b) they are perishable; and (c) the apple and pear surplus is widely dispersed, in places many of which are remote from distilleries.

Grapes.—Owing to war-time loss of overseas markets, there are prospects of an annual surplus of some 40,000 tons of grapes; this is a potential source of some 800,000 gallons of alcohol.

The cost of alcohol from grapes would exceed 6s. per gallon if a fair price £4 17s.6d per ton) were paid for grapes.

It has been suggested that the bounty of £200,000 formerly payable on export wine should be transferred to the anhydrous alcohol which could be made from that wine. If this transfer were made, the bounty, together with the return from sales of alcohol at present market prices, would approximately balance the cost of production of the alcohol. The amount of alcohol so produced would be small, but the grape industry might thus be maintained until overseas markets were restored.

Root Crops.—(Sugar beet, potatoes. sweet potatoes, Jerusalam artichokes, yams). There is no regular surplus of any of these crops in Australia. In respect of cost, none of them compares favourably with sugar or wheat as a source of alcohol.

Maize.—There is no regular surplus of maize in Australia. At a fair average price for maize (5s, a bushel) the cost of alcohol would be not less than 3s. 6d. per gallon.

Sorghum.—The production of sorghum is limited, and there are not reliable estimates as to the cost If sorghum were grown extensively it might compare favourable with wheat and sugar as a source of power alcohol, and some investigation of its possibilities is advisable.

Other Cereals.—There may be an unexportable surplus of barley during the war. There is no regular surplus of oats. Both these cereals deserve consideration as alternatives to wheat.

Tropical Crops.—The crops in Australian tropical Territories which might provide raw material for power alcohol are nipa palm, sago palm and cassava.

Nipa Palm, Sago and Cassava.—In Papua and New Guinea there are areas of nipa palm and sago large enough to supply raw material for the production of considerable quantities of alcohol. With proper control and cultivation these areas could be exploited without risk of the raw material becoming exhausted Cassava is not at present a widespread crop, but it could be grown satisfactorily in New Guinea and Papua and possibly in Northern Queensland.

There are no reliable data as to the costs of production of raw material and distillation in the Australian Territories, and transport of alcohol and of raw material to Australia. Tentative estimates indicated the following general level of costs: - (a) the cost of producing alcohol from nipa palm in Malaya, up to 1932, was about 3s. per gallon (Australian); alcohol production on a large scale might cost less in Papua, but not less than alcohol from wheat or sugar; (b) alcohol from sago or cassava grown in New Guinea would prodably cost in the region of 2s. per gallon if the raw material were converted in the Territory and the alcohol shipped to Australia. These estimates indicate no more than the need for further investigation.

The contentions that power alcohol production would supply the Commonwealth with an indigenous supply of fuel in case of a blockade and would contribute to the stabilization of agriculture are greatly weakened in respect of power alcohol produced from Papuan or New Guinea crops.

General financial and economic consideration.—

In order to assess the economic consequences of a power alcohol industry, it is necessary to weigh the extra costs against the national and social benefits of the industry.

Australia's normal peace-time requirements of motor fuel are, at a minimum, 350,000,000 gallons. If all this were to be a 15 per cent. alcohol blend, the nation's requirements of alcohol would be 52 500 000 gallons.

The extra cost to the community of replacing 52,000,000 gallons of petrol by alcohol is estimated by adding the loss of revenue from duty payable on this quantity of petrol to the extra cost of alcohol over that of duty-paid petrol. Examples are given assuming two costs of petrol and two levels of customs and primage. It is shown that, assuming the wholesale price of alcohol is 2s. per gallon, the total extra cost of producing 52,000,000 gallons of alcohol would, under present conditions, be £3,142,000. Spread over the cost of motor fuel to the community as a whole, this sum amounts to an increase of 2.15d. in the price of a gallon of fuel. The sum of 2.15d. is reduced to 1.65d. after allowance is made for the value received from the use of alcohol blend as a super fuel. A similar set of calculations is made for pre-war conditions. The duty-free cost of the petrol replaced would be £2,054,000.

Against this cost must be set:

(a) the strategic value of an indigenous supply of fuel, expansion of the power alcohol industry would be the quickest way to meet the need for the local production of some proportion of Australia's liquid fuel requirements;

(b) a contribution to the stabilization of agriculture; expansion of the power alcohol industry would provide a new outlet for crops which owing to the war or for other causes, may for some time to come have an unmarketable surplus. If a new outlet be not found for this crop surplus it will become a charge on the community in some other way.

The extra cost of power alcohol is higher than that usually prevailing in "normal protected industry". Nevertheless, alcohol has been sold at 1s.11d. per gallon for blending with petrol costing only 1s ½d., without enforcement by legislation, and the blend has been sold on the open market as a super grade fuel.

New distilleries

Factors affecting a decision on the sites for new distilleries are strategic consideraations; capacity of the State to absorb power alcohol; quantities of wheat and sugar in excess of home consumption; and speed with which distilleries could be erected.

Distribution of new distillery capacity is given on the basis of states requirements of alcohol in relation to petrol consumption; a distribution between wheat and sugar, based on using equal percentages of exportable quantities of these materials, is also given.

While a decision as to the location of distilleries would be a matter for the Government, a tentative distribution of distillery capacity between States is set out for purposes of illustration.

Constructional labour and equipment.

Unforeseen problems are not likely to arise in the design and fabrication of distilleries for sugar products, or for wheat using the malting process. The building of *distilleries* to operate on wheat by the amylo process presents certain difficulties. There is at present insufficient experience in Australia for the design and operation of a distillery to make alcohol from wood.

APPENDIX XII.

Number of Sugar Factories in existence working in India directly for cane and refining for Gur.

Serial No.	Name of Factory.	Location.	Daily cane crushing capacity (Tons)	Remarks.
WEST U. P. (Dehra Dun, Saharanpur, Muzaffarnagar, Bijnor, Moradabad districts) :—				
1.	The Vijai Sugar Corporation Ld. ..	Doiwala.	430	
2.	The Ganga Sugar Corporation Ld.	Deoband.	800-1000	
3.	Rai Bahadur Narain Singh Sugar Mills Ld.	Lhaksar.	1100-1200	
4.	The Lord Krishna Sugar mills Ld....	Saharanpur.	1000	
5.	The Amritsar Sugar Mills Co. Ld. ...	Rohana Kalan.	1100-1200	
6.	The Upper Doab Sugar Mills Co. Ld ...	Shamli.	1200	
7.	The Upper Jumna Swadeshi Sugar mills Co. Ltd. ...	Mansurpur.	1000-1100	
8.	The Upper India Sugar Mills Ld. ...	Khatauli.	1100-1150	
9.	The Dhampur Sugar Mills Ld. ..	Dhampur.	870	
10.	The Upper Ganges Sugar Mills Ld	Seohara.	1300	
11.	Seth Shiv Prasad Banarsi Dass Sugar Mills	Bijnor.	1100	
12.	Shri Diwan Sugar Mills ...	Sakhotitanda	400	
13.	Daurala Sugar Works.	Daurala.	1200	
14.	Jaswant Sugar Mills. ...	Mohana.	650	
15.	Ram Luxman Sugar Mills Ltd. ...	Mohiuddinpur.	750	
16.	Modi Sugar Mills Ltd.	Begamabad	800	
17	Simbhaoli Sugar Mills Ld ...	Simbhaoli.	750	
18.	The Muradnagar Sugar Works. ...	Muradnagar.	60	Not working.
19.	The Amroha Sugar Factory. ...	Amroha	350	
20.	The Ajudhia Sugar mills. ...	Raja ka-Sahaspur.	1000-1800	
21.	The Kesar Sugar Works Ld. ...	Baheri	1400	
CENTRAL U. P. (Nainital, Etah, Bareilly, Pilibhit, Kheri, Shahjahanpur Sitapur, Hardoi, Barabanki, Lucknow, Cawnpore, Allahabad Districts).—				
22.	H.R. Sugar Factory Ld. ...	Bareilly.	800	
23.	The Gokulnagar Sugar Mills Co. Ld ...	Kisha.	1000	
24.	L.H. Sugar Factories & Oil Mills Ld.	Kashipur.	500	
25.	Neoli Sugar Eactory.	Manpur-Nagaria.	850	
26.	L.H. Sugar Factories & Oil Mills Ld.	Pilibhit.	1750	
27.	The Hindustan Sugar Mills Ld. ...	Golagokarannath.	1800	
28.	The Aira Sugar Factory. ...	Khamaria	650	
29.	Carew & Co. Ltd . Rosa. ...	Rosa.	725	
30.	The Oudh Sugar Mills Ld. ...	Hargaon.	1800	
31.	The Lakshmiji Sugar Mills Co. Ld.	Maholi.	1650	
32	The Seksaria Biswan Sugar Factory Ltd.	Biswan.	1200	
33.	The Lakshmi Sugar & Oil Mills Ld.	Hardoi.	1400	
34.	The Bhurwal Sugar Mills Co Ld. ...	Bhurwal.	500	
35.	Ramchand & Sons Sugar Mills.	Aishbagh	860	
36.	The Kamalapat Motilal Gutaiya Sugar Mills.	(working with — Gutaiya cane and Gur)	1000 1500	Not working in 1944-45.
37.	The Shree Krishna Deshi Sugar Works.	Jhusi.	400	Not working.
38.	Trebeni Deshi Sugar Works. ...	Naini.	400	,,
39.	Baijnath Balmakund Sugar Mills. ...	Anwarganj.	(Gur only 27)	,,
40.	Experimental Sugar Factory IIST. ...	Cawnpore.	28	,,
41.	Cawnpore Sugar Works Ld. ...	Cooperganj	(Gur only 73)	,,
2 .	The Unao Sugar Mills. ...	Unao	(Gur only 75)	,,

Serial No	Name of Factory.	Location.	Daily cane crushing capacity (Tons)	Remarks.
EAST U P (Bahraich, Gonda, Basti, Gorakhpur Jaunpur Districts).—				
43.	R. B Seth Laxmandas Mohanlal Sugar Mills	Jarwal Road.	800	
44.	The Balrampur Sugar Co Ld.	Balrampur.	750	
45.	The Nawabganj Sugar Mills	(Katra) Nawabganj.	1850	
46.	Shree Sheodayal Sugar Mills Ld.	Lakarmandi.	100-150	Not working.
47.	The Saksaria Sugar Mills Ld.	Babhnan.	850	
48.	The Balrampur Sugar Mills Co. Ld.	Tulsipur.	750	
49	The Basti Sugar Mills Co Ltd.	Walterganj.	700-800	
50.	The Basti Sugar Mills Co Ld	Basti.	800	
51.	The Madho Kanhya Mahesh Gauri Sugar Mills Ltd.	Munderwa.	600-700	
52	The Barhni Sugar Mills.	Barhni	1000	
53	Shree Anand Sugar Mills Ld.	Khalilabad.	400	
54.	The Ganesh Sugar Mills Ld	Pharenda.	700-800	
55.	The Lakshmi Devi Sugar Mills Ld	Chitauni.	600-700	
56.	The Vishnu Pratap Sugar Works Ld.	Khadda	700	
57.	The Ledi Sugar Factory.	Ledi	80	Not working.
58.	The Mahabir Sugar Mills Ld.	Siswa-Bazar.	750	
59.	The Punjab Sugar Mills, Co Ld.	Ghughli.	850	
60.	The Shankar Sugar Mills Ld.	Captainganj.	850	
61.	Diamond Sugar Mills Ld	Pipraich.	700-800	
62.	The Pipraich Sugar Mills Ld.	Pipraich.	300	
63.	Saraya Sugar Mills Ld	Sardarnagar.	2000	
64.	Cawnpore Sugar Works Ld.	Gauribazar.	700	
65.	Shree Sitaram Sugar Co Ld	Baitalpur.	800-900	
66.	Sind National Sugar Mills Ld.	Deoria.	300	
67.	Noori Sugar works.	Bhanti.	700	
68.	The Ishwary Khetan Sugar Mills Ld.	Lakshmiganj	700	
69.	The Maheshwari Khetan Sugar Mills Ld.	Ramkola (M K.)	750	
70.	The Ramkola Sugar Mills Co. Ld	Ramkola.	900	
71.	The Padrauna Rajkrishna Sugar Works Ld	Padrauna.	1000	
72.	The Jagadish Sugar Mills Ltd.	Kathkuiyan.	400	
73.	The United Provinces Sugar Co. Ld.	Seorahi (Tamkohi Road)	925	
74.	Purtabpore Sugar Factory.	Mairwa.	800	
75.	Deoria Sugar Mills Ltd	Deoria	900	
76.	The Ratna Sugar Mills Co Ld.	Shahganj.	750	
77.	Campierganj Sugar Mills Ld.	Campierganj.	300	Not working.
	UNITED PROVINCES		62073/64073	
NORTH BIHAR (Champaran Saran, Muzaffarpur, Dorbhanga & Purnea Districts).—				
1.	Harinagar Sugar Mills Ld	Ramnagar.	1500	
2.	New Swadeshi Sugar Mills Ld.	Narkatiaganj.	800-900	
3.	Shri Krishna Gyanodoya Sugar Mills.	Lauriya.	650	
4.	Champaran Sugar Co Ld	Chanpatia.	850-900	
5.	Motilal Padampat Sugar Mills Co Ld	Majhowlia.	1000	
6.	The Sagauli Sugar works Ld.	Sagauli	900	
7.	Shree Hanuman Sugar Mills Ld.	Motihari.	750	
8.	The Champaran Sugar Co. Ld	Barrah Chakia.	900-1000	
9.	The Ganga Devi Sugar Mills Co. Ld.	Bagaha.	400	
10.	Sasamusa Sugar Works Ld.	Sasamusa.	650	
11.	The Vishnu Sugar Mills Ld.	Harkhua.	800	
12.	Shri Krishna Gayanoday Sugar Mills Ld.	Mirganj.	1400-1500	

Serial No.	Name of Factory.	Location.	Daily cane crushing capacity (Tons)	Remarks.
NORTH BIHAR (Contd).—				
13.	New Savan Sugar & Gur Refining Co. Ld.	Savan	700	
14.	Indian Sugar Works.	Siwanukhi.	1700	
15.	Bihar Sugar works.	Pachrukhi.	1000	
16.	Maharajganj Sugar Co. Ld.	Maharajganj.	300	Not working.
17.	Bharat Sugar Mills Ld.	Sidhwalia.	600	
18.	Cawnpore Sugar Works Ld.	Marhowrah.	900	
19.	The Sitalpore Sugar Works.	Sitalpore	900	
20.	The Belsund Sugar Co. Ld.	Riga.	850	
21.	The Motipur Sugar Factory Ld.	Motipur.	1200-1300	
22.	The Samastipur Central Sugar Co. Ld.	Samastipur.	778	
23.	Ryam Sugar Co. Ld.	Ryam.	778	
24.	Lohat Sugar Works.	Lohat.	1300	
25.	Sakri Sugar Works.	Sakri	700	
26.	The New India Sugar Mills Ld.	Hāsanpur Road.	1000	
SOUTH BIHAR (Bhagalpur, Shahabad, Patna and Gaya).—				
27.	The Ganga Deshi Sugar Factory Ld	Buxar.	100	Not working.
28.	Mohini Sugar Mills Ltd.	Bikramganj.	500-600	
29.	Rohtas Industries Ld.	Dehri-on-Sone.	1800	
30.	The South Bihar Sugar Mills Ld	Bihta.	1303	
31.	Gaya Sugar Mills Ltd.	Guraru.	650	
	BIHAR		26856/27.06.	
ASSAM —				
1.	Padmini Sugar Mills	Deopani	60	Not working.
BENGAL.—				
1.	Sitabganj Sugar Mills Ltd.	Sitabganj	700	Not working.
2.	North Bengal Sugar Mills Co Ld.	Gopalpur.	1250	
3.	Shree Radha Krishna Sugar Mills Ld.	Boldanga.	400	
4.	Ramnugger Cane & Sugar Co. Ltd	Plassey.	600	
5.	Carew Co. Ltd.	Darsana.	1300	
6.	The Kaliganj Sugar Mills Ld.	Kaliganj	150	Not working.
7.	The Deshbandhu Sugar Mills Ltd.	Charsindur.	250	Not working.
8	Dass Sugar Corporation Ld	Kishoreganj.	300	
9.	The Rajlakshmi Surgar Mills	Bhawanipur.	75	
	BENGAL		5225	
N. W. F. P.—				
1.	The Frontier Sugar Mills and Distillery Ltd.	Takhti Bhai.	400	
PUNJAB.—				
1.	The Gujranwala Sugar Mills Co. Ld.	Rajwali.	300-400	Not working
2.	The Amritsar Sugar Mills Co. Ld.	Amristar.	(Gur only) 42.	Not working.
3.	Saraswati Sugar Mills	Abdullapur.	450	
4.	The Pattoki Sugar Works	Pattoki.	100	Not Working.
	PUNJAB		892-1042	

Serial No.	Name of Factory.	Location.	Daily cane crushing capacity. (Tons)	Remarks.
SIND.—				
1.	The Pioneer Sind Sugar Co. Ltd.	Mohattanagar.	500	Not working.
ORISSA.—				
1.	Aska Sugar Works and Distillery	Aska.	100-120	
2.	Jeypore Sugar Co. Ltd.	Rayagadh.	150	
	ORISSA.		250-270	
MADRAS.—				
1.	Vizagapatam Sugar and Refinery Ltd.	Thummapala,	125	
2.	Etikoppaka Sugar Factory	Etikoppaka.	60	
3.	The Shri Rama Sugar Mills Ltd.	Bobbili.	150	
4.	The Vuyyuru Co-operative Agricultural Industrial and Credit Society Ltd.	Vuyyuru.	850-1000	
5.	The Kirlampudi Sugar Mills Ltd.	Kirlampudi	120	
6.	The Deccan Sugar & Abkari Co. Ltd.	Samalkot. (Gur)	40	
7.	The East India Distilleries & Sugar Factories Ltd.	Nellikuppam	1000	
8.	The India Sugar & Refineries Ltd.	Hospet.	500	
9.	Coimbatore Co-operative Sugar Manufacturing Society Ltd	Podanur. (Gur)	50	
10.	Al. Vr St. Sugar Mills & Distillery	Techunallur. (Gur only)	16	
11.	The Sri Ram Sugar Mills Ltd	Sitanagram.	300	
12.	T. A. Ram Lakshmi Sugar Mills Alvartirunagri.	Lakshanatope. (Gur only)	6	
13.	The Murugappa Sugar Ltd.	Mailpatti. (Cane)	75	
		Gur	10	Not working.
14.	The Southern India Sugar Co. Ltd	Pugalur	150-300	
	MADRAS		3452-3752	
BOMBAY.—				
1.	The Belapur Co. Ltd.	Belapur	1000	
2.	The Saswad Mali Sugar Factory	Malinagar.	450-500	
3.	The British Maharashtra Sugar Syndicate Ltd.	Borgaon.	300-350	
4.	Walchandnagar Industries Ltd.	Baramati.	1200	
5.	The Maharashtra Sugar Mills Ltd.	Tilaknagar.	1000-1200	
6.	The Ravalgaon Sugar Farm Ltd.	Ravalgaon.	600	
7.	The Godavary Sugar Mills Ltd.	Sakarwadi.	750	
8.	Shree Changideo Sugar Mills	Puntamba.	850	
9.	The Somaiya Sugar Factory	Lakshmiwadi.	700-750	
10.	The Belvandi Sugar Farm Ltd.	Belvandi.	250-300	
	BOMBAY		6600-7000	

INDIAN STATES.

KAPURTHALA STATE.—				
1.	The Mahalakshmi Sugar Mills Co. Ltd.	Hamira.	1200-1800	
2.	Jagatjit Sugar Mills Co. Ltd.	Phagwara.	750	
RAMPUR STATE.—				
3.	Raza Sugar Co. Ltd.	Rampur.	1000	
4.	Buland Sugar Co. Ltd.	Rampur.	1000	

APPENDIX XIII.

Imports of Sugar Machinery in India.

Whence Imported.		1930-31.	1931-32.	1932-33.	1933-34.	1934-35.	1935-36.	1936-37.	1937-38.	1938-39.	1939-40.
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
United Kingdom	...	10,82,836	26,22,991	91,48,018	1,95,87,559	73,60,509	49,70,581	68,49,673	43,64,189	30,16,630	...
Germany ...	...	23,233	1,18,670	17,83,649	33,11,442	11,41,661	10,74,103	12 09,318	12,61,132	13,86,501	...
Netherlands ..	...	...	...	10,88,971	60,53,605	6,81,545	1,05 324	4 16,189	1,45,260	2,23 122	...
Belgium ...	...	...	22,751	31,76,262	34 79,283	18,127	10,735	10,41,282	19 240	15,887	...
France ...	...	2,30,323	2 22,297	26,880	39,541	10,30,195	40,114		8 665	11,935	...
Italy ...	...	...	...	231	13,444	4,305	10,395		18,851	4,66,594	...
U. S. A. ...	...	32,324	27,382	16,324	22,021	70,389	1,13 640		1,87,506	2,40 877	...
Czechoslovakia	...	...	...	68,019	11,13,491	1,83,748	23,229		7,86,129	6,37,478	...
Java ...	...	...	...	...	...	32,428	2 20,180		1,72,463	1,34 662	...
Japan ...	...	...	...	...	...	20,586	...		9,062	109	...
Other countries	...	..	358	2,772	18,428	1,946	3,201		13,686	3,164	...
Total	...	13,68,716	30,14,449	1,53,11.126	3,36,38,814	1,05,45,439	65,71,502	95,16,462	69,86,183	61,36,959	50.84.254

APPENDIX XIV.

The attached statement shows the quantity of capital goods required for the sugar industry for—

(i) extensions to the existing plants and

(ii) for 20 new plants.

Only the principal items of machinery have been taken into consideration. The calculations have been based on the policy to be followed in future for the expansion of the sugar industry, iz —

(a) The size for a minimum economic unit is to be raised from 650 tons/day to 800 tons/day Thus capital goods requirements have been calculated for extensions to plants of 250 tons capacity or above so as to raise their capacities to 800 tons.

(b) For factories of 800 tons capacity or above the milling plants of 14 or 15 rollers are to be extended to plants of 17 or 18 rollers and a second set of knives is to be allowed. This in some cases amounts to an increase in capacity by 10 per cent. and in some cases by 5 per cent. The boiling house is to be balanced for this increased capacity. Capital goods requirements in respect of the above have been calculated.

As the post war demand of sugar will not be entirely met by the extended plants, new factories will have to be put up. Capital goods requirements for 15 new plants have therefore been included in the statement. Items marked with an asterisk relate to the new plants.

As regards goods which will have to be imported from abroad the items marked with double asterisk will have to be imported. The remaining items could be manufactured in India. It may, however, be stated that for juice heaters, evaporators, pans and centrifugals certain component parts such as brass-tubes, calandria plates , steam coils and centrifugal liners will have to be imported from abroad.

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Statement showing the quantity of Capital Goods required for extensions to the existing plants of Central Sugar Factories in India in Accordance with the proposed policy for extension and for additional 20 New plants (15 Double Sulphitation and 5 Carbonation plants)

Items of machinery.	For factories below 800 tons per day crushing capacity.	For factories above 800 tons per day crushing capacity.
1. Cane Knives ...	59 sets of Cane knives with engine of 90—100 B.H. ...	20 sets of cane knives with engines of 90—100 BHP. 2 ,, ,, ,, ,, ,, ,, ,, 170—125 BHP. 6 ,, ,, ,, ,, ,, ,, ,, 150 B.H.P. 15* ,, ,, ,, ,, ,, ,, ,, 90—100 B.H.P. 15* ,, ,, ,, ,, ,, ,, ,, 150 B.H.P.
2. Crushers & Mills * ...	121—3 roller mills or crushers 24"×48" 3— do 26"×52" 6— do 27"×54" 3— do 28"×56" 4— do 30"×60" ...	10—3 roller mills or crushers 24"×48' 6—3 do 26"×54" 10— do 28"×56" 10— do 30"×60" 3— do 32"×64" 2— do 34"×66" 1— do 35"×78" 15*—2 roller crushers of 28"×56" 75*—3 roller mills 28"×56"
3. Juice Heaters ...	47 of 500 sq. ft H.S. each 50 of 600 do 19 of 700 do ...	9 of 500 sq. ft. H.S. each. 27 of 600—700 sq. ft. H.S. each. 28 of 700—800 ,, ,, ,, 2 of 1000 ,, ,, ,, 65* of 700 ,, ,, ,,
4. Juice Sulphuring tanks ...	68 of 1000 gallons capacity each ...	22 of 1520 Gallons capacity each. 14 of 1200 do 5 of 500 do 40* of 1520 gallons each.

Items of machinery.	For factories below 800 tons per day crushing capacity.	For factories above 800 tons per day crushing capacity.
5. Settlers or Dorr Clarifiers.	94 settlers of 1000 gals. capacity each. 11 do 1200 do 7 do 800 do 8 Dorr Clarifiers 30′ dia.×3 compts. 7 do 18′ dia.×4 ,, 1 do 16′ dia.×3 ,, 7 additional compartments to existing Dorr of 18′ dia.×3 compartments.	5 Settlers of 1200 gallons capacity each. 5 Dorr Clarifiers of 20′ dia.×4 compartments. 4 Additional compartments to existing Dorr of 18′ dia.×3 compartments. 10* Dorr clarifiers of 20 dia ×3 compartments.
6. Sulphur Furnaces ...	12 of 3 sq. ft. tray area each. 10 of 4 do 5 of 5 do 13 of 6 do	2 of 3 sq. ft. tray area each. 2 of 5 sq. ft., etc. 5 of 6 do 3 of 8 do 30* of 5 do 10* of 3 do
7. Air Compressors** ...	15 of 100—150 cu. ft. air displacement per minute. 13 of 200—250 do 3 of 250—300 do	6 of 100—150 cu. ft. air displacement per minute. 7 of 200 do 4 of 300 do 1 of 400 do 20* of 200 do 5* of 150 do
8. Filters ...	52 of 450—500 sq. ft. filtering area each 126 of 600—650 do 8 of 700—800 do	6 of 500 sq. ft. filtering area each. 97 of 600 650 ft. ,, ,, ,, 18 of 700—800 ,, ,, ,, ,, 90* of 650 sq. ,, ,, ,, ,, 50* of 750 ,, ,, ,, ,, ,,

Items of machinery.	For factories below 800 tons per day crushing capacity.	For factories above 800 tons per day crushing capacity.
9. Evaporators ...	20 Quadruple effect evaporators of 1200 sq. ft. H.S. each. 6 ,, ,, ,, 8500 do 2 6 ,, ,, ,, 6000 do 3 3 ,, ,, ,, 4500 do 1 2 Tripple ,, ,, 9000 do 2 7 ,, ,, ,, 4500 do 4 4 ,, ,, ,, 3600 do 3 14 Pre-evaporators of 2500—3000 do 8 H.S. each.	3 Quadruple effect evaporators of 1400 sq ft. H.S. each. Do do 8500 do Do do 6000 do Do do 4500 do Tripple effect do 7500 do Do do 4500 do Pre-evaporators of 4500—5000 sq ft H.S. each. Do 3500 sq. ft. H.S. each. 15* Quadruple effect evaporators of 14,000 sq. ft. each.
10. Vacuum Pans ...	8 Calandria Vacuum Pans of 1200 sq. ft. H.S. & 25 tons capacity each 26 do of 1000 sq. ft. H.S. & 22 do 33 do of 850 do & 20 do 6 do of 600 do & 18 do 2 Coil Vacuum Pans 800 sq ft. H S. and 22 tons capacity. 30 do 600—650 sq. ft. and 20 tons capacity each.	18 Calandria Vac. pans. 1100—1200 sq. ft H.S- and 25 tons each. 16 do 800 – 900 do 20 do 3 do 1000 do 22 do 3 Coil pan Vac pans 850 sq. ft. H.S each 22 tons do 8 do 600—650 do 20 tons do 45* Calandria Vac pans 1000 sq. ft. H.S. 25 tons each. 30* Coil Pans 650 do 20 do
11. Injection water Pumps**	13 of 2.5 lakh gallons per hr. capacity each, with high speed engines. 4 of 2.0 do do do 15 of 1·5 do do do 29 of 1·0 do do do	4 of 3·5 lakh gals. per hr. capacity each. 7 of 2—2·5 ,, ,, ,, ,, ,, 16 of 1·5 ,, ,, ,, ,, ,, 15 of 3 ,, ,, ,, ,, ,,
12. Dry Air Pumps** ...	2 of 1800 cu. ft. Air displacement per mt. each 19 of 1000 1200 do do 6 of 800—1000 do do 10 of 500 - 600 do do	... 3 of 2000 - 2500 c.ft. air displacement per mt. each 1 of 1500 do do do 7 of 1000—1200 do do do 6 of 500 - 600 do do do 7 of 750 do do do 30* of 1000—1200 do do do

BASIS.		2200 galls/day (660,000 galls/annum)			4400 gall/day (1320000 gall./annum)			6600 galls./day (1980000 galls/annum)		
ITEMS		Quantity	Rate	Total	Quantity	Rate	Total	Quantity	Rate	Total
1. Fuel ...	Process Expenses.	1770 tons	27/-	£2390	3241 tons	26/-	£4200	4420 tons	25/-	£5 525
2. Acid Sulphuric ...		9000 gals	4/-	1800	18000 galls	3/6	3100	27000 gals	3/-	4,050
3. Ammonium Sulphate		11 tons	£11	121	22 tons	£10/10	200	33 tons	£10	330
4. Labour-General ...				1500			2000			2,250
5. Labour Supervisory & Technical ...				800			1000			1,200
6. Light, Power, Oils, Greases, cleaning materials, etc, etc. ...				200			300			400
7. Upkeep & maintenance ...				200			400			600
8. Entrainer losses ...				150			100			200
9. Depreciation on plant ...	Additional charges.	£50000	10 per cent.	5000	£73000	10 per cent.	7300	£95000	10 per cent.	9,500
10. Depreciation on buildings ...		20000	5 ,	1000	23000	5 per ,,	1100	26000	5 ,	1,325
11. Depreciation on capitalised royalty at 10 per cent.		800	10 ,,	80	1600	10 ,,	100	2400	10 ,,	240
12. Interest on total capital ...		80000	5 ,,	4000	110000	5 ,,	5500	140000	5 ,,	7,000
13. Insurance, etc. ...				300			500			700
TOTAL ...				£17,541 per year.			£26100			£3,3320
1. Cost per gal. of absolute alcohol if molasses is assumed to be a waste product of no value				6·4*d.* or 5·69 annas			4·75 4·22			4*d* or 3 56 annas
Cost per gal. of absolute alcohol if molasses be taken at 2 as. per md. (at distillery)		10650 tons	2 annas	7 35*d.* or 6·53 annas	20770 tons	2 annas	5·7 5 07	Add 30,000 tons	Total 2 as.	cost 4 95*d.* or 4.40 As.
Do do 4 as. do.			4 annas	8 30*d.* or 7·38 annas		4 annas	6 63 5·89		4 as.	5 85*d.* or 5·20 annas

Items of machinery.		For factories below 800 tons per day crushing capacity.		For factories above 800 tons per day crushing capacity.
13. Crystallizers	...	7 of 700 cu. ft. each 92 of 600 cu ft. each. 91 of 500 cu. ft. each.	...	9 of 850 cu. ft. each. 4 of 750 do 46 of 600 do 10 of 500 do 105* of 700 cu. ft. each. 60* of 600 do
14. Centrifugals	...	318 machines of 36″×18″ size 432 machines of 30″×18″ size	...	30 machines of 42″×20″ 294 ,, ,, 36″×18″ 109 ,, ,, 30″×18″ 480* ,, ,, 36″×18″
15. Boilers**	...	37 of 3000—3500 sq. ft H.S. each 26 of 4000—4500 do	...	5 of 5000 sq ft. H.S. each 10 of 4000–4500 sq. ft H.S. each 4 of 3000—3500 do 60* of 4000 sq. ft. H.S. each.
16. Lime Kilns	...	4 of 1000—1200 c.ft. Capacity each 1 of 500 do	...	4 of 1500 c ft. capacity each 1 of 800 do 5* of 1500 do
17. Gas Pumps**	...	4 of 1200 c.ft. air displacement per mt. 1 of 650 do do	...	2 of 2000 c.ft. air displacement per mt. each 2 of 1500 c.ft. ,, ,, ,, ,, ,, 1 of 1000 c.ft. ,, ,, ,, ,, ,, 2 of 800 c ft. ,, ,, ,, ,, ,, 5* of 1500 c.ft. ,, ,, ,, ,,
18. Carbonation tanks	...	......		20* tanks of 300 c ft. capacity each. 5* tanks of 250 ,, ,, ,,

*Denotes machinery required for proposed 20 New Plants of 1000 tons daily crushing capacity (15 Sulphitation and 5 Carbonation Plants)

** Denotes machinery which has to be imported from abroad.

Items of Machinery.	Additional Machinery other than shown above required for 20 New Plants af 1000 tons each.
1.	20 Cane carriers 56″ wide, 120 ft. long between centres.
2.**	20 Vertical two Cylinder coupled steam engines, 8″ dia.×12″ stroke.
3.	120 Sets of hydraulic attachments.
4.	120 sets of hydraulic accumulators of differential type.
5.	100 Slat type intermediate carriers
6.**	40 low type compound gearings.
7.**	30 horizontal steam engines corliss valve or piston valve type each of 3.50 I.H.P.
8.**	40 duplex type pumps, steam cylinder 12″ dia, pump cylinder 8″ dia.×12″ stroke.
9.**	150 duplex type pumps, steam cylinder 8″ dia. pump cylinder 6″ dia.× 8″ stroke.
10.**	20 overhead travelling cranes, 12 tons capacity.
11.	20 all steel rake type bagasse elevator 40 ft. long between centres.
12.**	20 automatic juice weighing scales to deal with 12,000 galls. of juice per hour.
13.**	15 duplex type steam pumps of 7500 gallons per hour capacity.
14.**	15 vertical belt driven double ran milk of lime pumps with rams 3″ dia.×6″ stroke each.
15.**	40 duplex type steam pumps (as per item No 9) but fitted with ball valves.
16.**	120 belt driven geared plunger type molasses pumps.
17.**	40 duplex steam pumps for driving centrifugals.
18.	40 Mugme mixers of 2000 ft. capacity each.
19.	20 screw conveyors.
20.	40 Grass-hoppers.
21.**	40 horizontal belt driven double acting massecuite pumps size 8″×10″.
22.	20 boiler house bagasse carriers of the return loop type.
23.**	20 30-H.P. steam engines.
24.**	40 Weir type double acting feed water pumps.
25.**	40 belt driven centrifugal pumps, capacity 20,000 gallons per hour.
26.	20 steel chimneys 9 ft 6 in. dia.×160 ft high.
27.**	20 electric lighting plants each consisting of one 50 K.W. generator for 220 volts.
28.**	20 25 K W belt driven generator for 220 volts.
29 **	20 workshop crude oil engines of 6 B.H.P. each.
30.**	80 engines of suitable sizes to drive machinery in sections.
	For Carbonation plants (Clarification section only)
1.**	25 electrically driven centrifugal pumps of 12,500 gallons capacity per hour.
2. *	5 steam driven press pumps of 12,500 gallons capacity per hour of the ball valve type.
3.**	5 Pumps of 4,000 gallons capacity per hour.
4.**	5 electrically driven pumps of 4,000 gallons capacity per hour. The dia. of the outlet to be 4″
5.**	5 Filter cloth washing machines—72″ dia.×36″ wide.

**Denotes machinery which has to be imported from abroad.

APPENDIX XV.

List of Principal Distilleries Capable of Manufacturing Rectified Spirit.

Province.	Name of Distilleries.	Capacity per month: (B. G. Gallon).
Bihar.	Marhowrah Distillery, Marhowrah.	24,120
Bombay.	The Government Central Distillery, Nasik Road.	78,250
...	Walchandnagar Industries Ltd. Bombay (Kalambh)	40,000*
Bengal.	Russa Distillery, Calcutta.	25,000
	Carew & Co. Ltd., Darsana.	62,500
	Bengal Distillery, Konnagar.	20,020
	United Distillery, Calcutta.	3,120
Madras.	East India Distilleries, Nellikupam.	28,750
	Parry & Co. Ltd., Samalkot.	2o,000
Punjab.	Amritsar Distillery Co., Ltd., Khasa.	26,320
	Karnal Distillery Co., Ltd., Karnal.	15 620
	Murree Brewery Ltd., Rawalpindi.	10,000
United Provinces.	Co-operative Distillery, Saharanpur.	18,000
	Standard Refinery and Distillery, Unao.	24.000
	Indian Distillery, Cawnpore.	16,000
	Cawnpore Sugar Works Distillery, Cawnpore.	19,600
	Carey & Co., Ltd., Rosa.	34,400
	Central Distillery and Chemical Works Ltd., Meerut Cantt.	57,000*
	Dyer Meakins Distillery, Lucknow	20.000
	Daurala Distillery & Central Works, Daurala.	49,000*
	Nawabganj.	60,000
	Raja-ka-Sahaspur.	60 000
	Shimbhaoli.	60.000
	Shamli.	60,000
	Captainganj.	60,000
	Hargaon.	60.000
	Golagokarannath.	60,000
Central India.	Cox's Distillery, Nowgong.	24,000
States :—		
Mysore.	Mysore Sugar Works, Maldya, Bangalore.	45,000*
Hyderabad.	Hyderabad Construction Co., Ltd. (Bodhen Distillery, Hyderabad Dn.)	60,000*
Rampur.	Rampur Distillery,	45,000
Travancore.	Parry & Co. Ltd., Nagercoil.	20,000
Baroda.	Alembic Chemical Works.	20,000

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* These distilleries are also capable of manufacturing power alcohol.

APPENDIX XVI

Estimate of Cost of Production of Power Alcohol Prepared by the Aluminium Plant & Vessel Co. Ltd.

UNIT SIZE

BASIS	2200 galls /day (660,000 galls/annum)			4400 galls/day (1320000 galls/annum).			6600 galls./day (1930000 galls/annum)		
	Quantity	Rate	Total	Quantity	Rate	Total	Quantity	Rate	Total
1. Quantity of Absolute Alcohol produced per hour ...	92 Galls.			163 Galls.			275 gallons		
2. Yield of Absolute Alcohol per ton of molasses ...	62 Galls.			64 ,,			66 ,,		
3. Molasses required per day based on 2 ...	35 5 tons			69 2 tons			100 tons		
4. Molasses required per year of 300 days based on 2 ...	10650 tons			20770 tons			30000 tons		
1. Cost of fuel taken at calorific value equal to coal ...		27/- per ton			26-per ton			25 per ton	
2. Steam required per gallon of alcohol produced ...	37 lbs.			36 lbs.	–		35 lbs.		
3. Fuel required at boiler per gallon of alcohol produced ...	6 lbs.			5 5 lbs			5 lbs.		
1. Sulphuric Acid, cost of		4/- per gall.			3/6 per gall.			3/- per gall.	
2. Ammonium Sulphate, cost of		£11/- per ton			£10/10 per ton			£10 per ton	
1. Capital for plant and buildings complete and started up ...		10 per cent.	£70000			£96,500			£121,500
2. Depreciation on plant taken at, per cent. ...		5 per cent.			10 per cent,			10 per cent.	
3. Depreciation on buildings, etc., per cent. ...		,,			5 per cent.			5 ,,	
1. Total capital (including working) ...			£80000			£110,000			£40,000
2. Rate of Interest on Capital ...		5 per cent.			5 per cent.			5 per cent.	

APPENDIX XVII.

Main Requirements of Equipment for 1,000,000 gallon Distillery.

1. Conventional Type of Plant

Basis: Daily throughput of 3300 gallons of alcohol (total) employing a fermentations giving an average wash containing 5% alcohol.

Designs are based on handling 3000 gallons of wash every hour against the theoretical quantity of 2750. Open fermentation vessels would be used and no attempt made to collect or wash Carbon Dioxide, or to recover Yeast.

Anticipated yield 44/45 parts of alcohol by weight per 100 parts of sugar (hexose) used in the distillery.

By employing the "Fourth Technique" distillation plant about 4% of the alcohol made would be recovered as "heads" or low quality spirit suitable for methylation the remainder being absolute alcohol about 99.8% by volume. Oils would be removed and would give a yield of about ¼% on the alcohol.

No allowance is made for storage tanks either for the molasses used as raw material or for the alcohol produced other than the "daily run down tanks".

It is assumed that tubewell water at 85 deg F. is available for cooling and that this will also be used for making up the molasses wort.

Item.	*Name.*	*Origin.*
1.	Main Molasses Pump & Standby with electric motor	India or Import.
2.	Overhead molasses Tank (¼" m.s. plate).	India
3	Molassess Controller & Standby with electric motor ...	Import.
4.	Ammonium Sulphate Dissolver. 3/8" m.s. lined 10 lb. lead with elec. motor	India.
5.	Ammonium Sulphate Overhead Tank. ¼" m.s lined 10 lb lead. ...	India.
6.	Ammonium Sulphate Constant Head Tank. ¼" m.s. lined 10 lb. lead.	India.
7.	Acid Egg, ½" m s.	India.
8.	Acid Stock Tank. ¼"m.s	India.
9.	Acid Dilution Tank ¼" m s lined 10 lb. lead	India.
10.	Main Water Tank m.s. sections	India
11.	Water Constant Head Tank. ¼" m.s.	India.
12.	Wort Balance Tank ¼" m.s.	India.
13	Molasses Diluter – ¼" m s. plate with electric motor ...	India.
14.	Wort Pumb and Standby with elec. motor	Import.
15.	Yeast Machine Tinned copper	India
16.	Air Compressor	Import.
17.	Open Fermenting Vessels – ½" m.s. plate. 12 off @ 12,000 gallons w.c. each.	India
18	Main Wort Pump & Standby with electric motor ...	Import.
19.	Open Bub Vessels per %¼" m.s. plate 3 off @ 3,000 gallons w.c	India.
20.	Bub Wort Sterilising Tower. Copper and Mild steel. ...	India
21.	Bub Wort Heat Exchanger. G.M. Copper & C.I. ...	Import.
22.	Sludge vessel—¼" m.s.	India.
23.	Sludge Pump with electric motor	Import.
24.	Main Water Pump & Standby with elec. motor	Import.
25.	Piping & Valves for fermentation system including special controls etc.	India. Raw materials imported.
26.	Fourth Technique Distillation Plant with hot decantation	India.
	(a) Columns, condensers and Decanters in copper ...	Raw materials mainly imported.
	(b) Pumps with electric motors.	Import.
	(c) Piping & Valves.	India Raw materials imported
	(d) Special control valves	Import.
27.	Instruments.	Import.

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28. "Daily run down" tanks. 3/16" m s. ... ... India.

Process Plant approx : Steel 130 tons.
Copper 36 tons.
Lead 2 tons.

Tonnage of Pumps, Compressors etc. in addition to above ... ... 15 tons.

The cost of the items mentioned above is a little difficult to assess but the following should serve as a rough guide.

Total cost of equipment only erected on site ... Rs. 5,30,000.

Of this the majority would be spent in India but the finished items—such as Heat Exchangers, Instruments, Special Valves, Pumps, etc imported would cost approximately Rs 1,00 000. This does not include copper sheet, steam valves etc. normally considered general Engineering Stock. If it is found possible to purchase molasses and some other pumps locally this Rs. 1,00,000 could possibly be reduced by Rs. 20,000

In addition to the above it would be necessary to provide a *building* which would normally be a steel framed structure with asbestos sheeting This would probably cost something like Rs 1,30,000 and might involve 100/150 tons of structural steel reinforcing bars etc.

In most cases also a separate boiler and generating station would be required as its acquisition would yield a better overall efficiency than taking steam and power from a Sugar Factory except under exceptional circumstances. This would involve a total normal steam capacity of about 1000 lbs per hour coupled with a generator of about 100 k w. This would cost about Rs. 1,00,000 The majority of this would have to be spent abroad say Rs 85 000.

Hence total cost of distillery apart from office accommadation, main storage (for raw materials and product) quarters (if required) sidings or fuel storage etc. Rs. 7,60,000,

It seems reasonable to assume that the total expenditure should not exceed Rs. 9,00,000 to Rs 10,00,000, it being assumed that sidings, quarters etc would either be available or be easily obtained as should be the case if the distillery is built on the site of an existing Sugar Factory. Of this Rs. 9 lacs to Rs. 10 lacs not more than about Rs. 1.85 to Rs. 2 lacs being spent on imported units of plant.

The question of Royalties on the Fourth Technique plant is not discussed.

2. Modern Type of Plant.—

Basis: Daily troughput of 3300 gallons alcohol (total) employing a fermentat giving an average wash containing 7/8% alcohol.

Designs are based on handling 2000 gallons of wash every hour against the theoretical quantity of 1840. Closed fermentation vessels would be employed and the Carbon Dioxide washed to recover alcohol. Owing to the type of fermentation used practically no yeast would be produced.

Anticipated minimum yield—48½ parts of alcohol by weight per 100 parts of sugar (hexose) used in the distillery. "Fourth Technique" distillation plant would be employed and 4% of the alcohol would be recovered as "heads" (see above) the remainder being absolute alcohol at about 99.8% by volume. Oils would be separated.

"Daily run down" tanks are included but not the main store tanks.

Tube well water at 85 deg. F. for cooling and wort preparation is assumed.

The whole of the items mentioned under Section 1 would be required except the following :—

Item 20. Bud Wort Sterilising Tower.

Item 21. Bub Wort Heat Exchanger.

The following items would be modified.

Item 17. Fermenting Vessels would be closed and have a total capacity of only 80,000 galls. (w.c) instead of 1,44,000.

Item 19. The Bub vessels would be closed.

The following items would be extra —

Item.	*Name.*	*Origin.*
(a)	Carbon Dioxide Scrubbing Tower-mild steel and cast iron.	India.
(b)	Carbon Dioxide Blower with electric motor.	Import.
(c)	Yeast handling equipment and coolers stainless steel, copper, gunmetal and cast iron.	Import.

Materials needed would be as follows :—

Process plant approximately:

Steel	110 tons
Copper	32 tons.
Lead	2 tons.
Tonnage of pumps Compressors, Instruments, Yeast Machinery Imported all in addition to above ...	25 tons.

Total cost of equipment only erected on site ... ... Rs. 5,80 000.

Of this the amount spent abroad would be about Rs. 1,50,000 exclusive of imported copper etc. as described under Section 1. Possible saving on pumps if available in India about ... Rs. 20,000.

The building required would be of same type as that described under Section I but appreciably smaller—also approx. (steel say 80/130 tons) ... ... Rs. 1,10,000.

The boiler - generator plant would need to produce about 6000 lbs. of steam per hour and generate about 00 k w. approx. price ... Rs. 90,000

(Of this about Rs. 75 000 would be spent abroad).

Total cost on same basis as section I approximately ... ... Rs. 7,80,000.

It is seen that the total cost is little different from that envisaged for a Conventional plant but the expenditure abroad is about Rs. 2,35,000 instead of Rs. 1,85 000.

The question of Royalties on the Fourth Technique Plant or the Yeast Process is not discussed.

NOTE :—In ' modern" process yeast is removed from a finished vessel and used to inoculate a new one. As this speeds up fermentation special methods are required for maintaining correct temperatures.

In the ' conventional" process a fermentation vessel cycle of 48 hours will be needed.

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APPENDIX XVIII.

Cost of Erection of Food Yeast Plant.

Cost of a 1-Ton Installation.—

Basis: A daily throughput of one ton per day of food yeast Designs are based on the assumption that molasses will contain 50% fermentable sugars and that 60% by weight on the sugar is covered as dry yeast. Hence the daily requirement of molasses will be about 3 tons.

It will be necessary to handle about 400 gallons per hour of fermented wash containing about 2.4% by weight of dry yeast.

No allowance is made for Storage Tanks for the molasses used as raw material.

No allowance is made for godown or for bags for receiving the finished products, but it should be noted that the normal package is a 1 cwt. hessian bag lined with waterproof paper.

It is assumed that cooling water at 85 deg. F. is available. this forming an important item in the plant owing to the fact that the temperature of the fermentation must be strictly controlled.

Description of plant.

A plant capable of producing one ton of food yeast per day would consist of the following items:

S.S =stainless steel.

Item No.	*Description.*	*Origin.*
1.	Molasses pump and standby with electric motor ...	Import or India.
2.	Overhead Molasses Tank—¼″ m.s. plate	India.
3	Overhead Water Tank with m.s sections	India.
4.	Constant Head Water Tank ¼ m s.	India.
5.	Molasses Controller with elec motor	Import.
6.	Molasses Mixer with elec. motor	India.
7.	Wort Preheater in gunmetal and copper	Import.
8.	Steam Injector.	Import.
9.	Wort Balance Tank—¼ m.s.	India.
10.	Wort Pump and standby with elec motor.	Import or India.
11.	Filters in cast iron	India.
12.	Wort Distribution Piping and Regulators s s. ...	Import.
13.	Three fermenting Vessels 1600 galls. working capacity s s. (s.s. to be imported)	India.
14.	Wort Coolers s s.	Import
15.	Circulating Pumps with elec. motor	Import or India.
16.	Air Blowers with elec motors	Import.
17.	Air Filters—m.s. and glass wool	India.
18.	Overflow Tank—s.s. (raw material imported) ...	India.
19.	Five Yeast Separators—s.s. etc.	Import.
20.	Yeast Cream Tank—s s (raw material imported) ...	India.
21.	Two Yeast Driers with elec. motors.	Import.
22.	Yeast Bogevs (aluminium.)	India.
23.	Chemical Dissolvers s.s (raw material imported) ...	India.
24.	Chemicals Holding Tanks s.s. (—do—)	India.
25.	General Piping (raw materials imported.)	India.
26	Instruments	Import.
27.	Tubewell Pumps	India.

Weight of mild steel needed 12/15 tons.

It is estimated that the total cost of the above plant would be Rs 3,50,000. This will be made up of equipment Rs. 2,80,000, buildings Rs. 50,000 and erection Rs. 20,000. Of the money spent on equipment, the cost of imported items would be about Rs 1,50 000 of which it might be possible to save upto Rs.6,000 by purchasing certain pumps etc. locally. The weight of stainless steel which would have to be imported would be approximately 3 tons but the costliest items of all are those concerned with yeast separation and yeast drying.

General Estimates.

It is estimated that for larger plants the following costs would be reasonable :

12 tons per day plant buildings etc.	Rs. 14,00,000
Boiler house and generator if required	Rs. 2,00 000
5 tons per day plant, buildings etc	Rs. 8,00,000
Boiler house and generator if required	Rs. 1,40,000
1 ton per day plant, buildings etc.	Rs. 3,50,000
Boiler house and generator if required	Rs 60,000

It should be noted that the calculatad costs of the production of food yeast in plants of the above sizes is as follows. (It being assumed that molasses is available at annas 4 per maund on site).

12 tons plant	As. 3	—	or allowing	50%	margin	As 4½/	lb.
5 tons plant	As. 4	—	do	do	do	As. 6	lb.
1 ton plant	As 6	—	do	do	do	As. 9	lb.

These figures assume that boiler house and generators are built in with the main plant. If it is desired to purchase steam at about Rs 5/- per ton and power at about anna 1 per unit the price of the 5 ton plant would rise to 7.5 annas per lb. and for the 1 ton plant 10.5 annas per lbs

All the above figures are calculated assuming costs of raw materials such as caustic, phosphates, etc. as those given in the Special Officer's report for pre-war conditions.

Materials —

It will be noted that the following ratios of cost exist :

1 ton plant	...	...	Unity.
5 tons plant	...	...	2.32
12 tons plant	...	...	4.06

The material requirements will be roughly in these ratio also. It should be noted that a large plant would normally require some kind of mechanical handling for the finished product—i.e. the dry yeast leaving the driers would be artificially consolidated, raised by a conveyor to a convenient height and delivered to a hopper for filling bags. Mechanical handling of the bags would not be necessary. Such arrangments are included in the price of the 12 ton unit but not in the others.

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1	2	3
Situation of Sugar Factory.	Cane Crushing Capacity Ton/Day.	Proposed Annual Production of Power Alcohol.
BOMBAY : - *contd*:		
Group II.--Distillery Proposed at Kalamb.		
1. *Kalamb* ...	1200	
2. Saswadmali ...	500	
3. Ugar Khurd ...	500	6 lac. gallons.
4. Phaltan ...	650	
	2850	
MADRAS and ORISSA :—		
Group I.—Distillery Proposed at Vizagapatam.		
1. Rayaghada ...	150	
2. *Vizagapatam* ...	125	
3. Ettikoppaka ...	60	
4. Bobbili ...	150	4 lac gallons.
5. Vuyyuru ...	900	
6. Kirlampudi ...	120	
7. Samalkot ...	40	
8. Seethanagram ...	300	
	1845	
Group II.—Distillery Proposed at Nellikuppam.		
1. *Nellikuppam.* ...	2000	4 lac. gallons.

Estimated total production of
Power Alcohol *in India* ....189 lac. gallons.

APPENDIX XIX

Statement showing the proposed location of the Distilleries for the manufacture of Power Alcohol.

1	2	3
Situation of Sugar Factory.	Cane Crushing Capacity Ton/Day	Proposed annual production of Power Alcohol
UNITED PROVINCES		
Group I—Distillery Proposed at Saharanpur.		
1. *Saharanpur* ...	1250	10 lac. gallons.
2. Shamli ...	1400	
3. Lhaksar ...	1100	
4. Doiwala ...	520	
5. Deoband ...	950	
	5220	
Group II—Distillery Proposed at Daurala.		
1. *Daurala* ...	1245	10 lac. gallons.
2. Saknotitanda ...	714	
3. Khatauli ...	1150	
4. Mansurpur ..	1050	
5. Rohanakalan ...	1140	
	5299	
Group III—Distillery Proposed at Simbhaoli.		
1. *Simbhaoli* ...	735	6 lac. gallons.
2. Meerut ...	650	
3. Begamabad ...	939	
4. Mohiuddinpur ...	750	
	3074	
Group IV.—Distillery Proposed at Rajakasahaspur		
1. *Rajakasahaspur* ...	1000	9½ lac. gallons.
2. Amroha ...	500	
3. Dhampur ...	897	
4. Seohara ...	1260	
5. Bijnor ...	1058	
	4715	
Group V.—Distillery Proposed at Baheri.		
1. Kashipur ...	650	9 lac. gallons.
2. Kichha ...	750	
3. *Baheri* ...	1279	
4. Bareilly ...	902	
5. Neoli ...	873	
	4454	

1	2	3
Situation of Sugar Factory.	Cane Crushing Capacity Ton/Day.	Proposed Annual Production of Power Alcohol

UNITED PROVINCES -*contd.*

Group VI – Distillery Proposed at Gola or Haragaon

Situation of Sugar Factory.	Cane Crushing Capacity Ton/Day.	Proposed Annual Production of Power Alcohol
1. Pilibhit ...	1530	13 lac. Gallons; both Gola and Hargaon have licences for distilleries at present.
2. Gola ...	1732	
3. Hargaon ...	1924	
4. Biswan ...	800	
5. Aira ...	650	
	6636	

Group VII. – Distillery Proposed at Hardoi.

Situation of Sugar Factory.	Cane Crushing Capacity Ton/Day.	Proposed Annual Production of Power Alcohol
1. Rosa ...	762	10 lac. gallons; the surplus molasses might be utilised by the existing units at Rosa, Cawnpore Sugar Works Unao and Dyer's distilleries which are not likely to consume much in the post war period.
2. Maholi ...	1250	
3. *Hardoi* ...	1565	
4. Barabanki ...	793	
5. Masodha ...	750	
6. Shahganj ...	751	
7. Jhusi ...	529	
	6[illegible]00	

Group VIII.—Distillery Proposed at Nawabganj.

Situation of Sugar Factory.	Cane Crushing Capacity Ton/Day.	Proposed Annual Production of Power Alcohol
1. Burwal ...	650	9½ lac. gallons.
2. Jarwal Road ...	861	
3. *Nawabganj* ...	167[illegible]	
4. Balrampur ...	768	
5. Tulsipur ...	746	
	4703	

Group IX. – Distillery Proposed at Basti.

Situation of Sugar Factory.	Cane Crushing Capacity Ton/Day.	Proposed Annual Production of Power Alcohol
1. Barhni ...	8[illegible]2	10 lac. gallons.
2. Pharenda ...	723	
3. Babhnan ...	793	
4. Walterganj ...	760	
5. *Basti* ...	831	
6. Munderwa ...	697	
7. Khalilabad ...	555	
	5176	

Group X.—Distillery Proposed at Captainganj

Situation of Sugar Factory.	Cane Crushing Capacity Ton/Day.	Proposed Annual Production of Power Alcohol
1. Pipraich (2 Factories) ...	1095	10 lac. gallons.
2. *Captainganj* ...	896	
3. Chunghli ...	782	
4. Siswabazar ...	620	
5. Khadda ...	756	
6. Chhaitauni ...	700	
	4849	

1		2	3
Situation of Sugar Factory.		Cane Crushing Capacity Ton/Day.	Proposed Annual Production of Power Alcohol.
UNITED PROVINCES—*contd.*			
Group XI—Distillery Proposed at Sardarnagar.			
1.	Lakshmiganj	732	
2.	Ramkola (2 Factories)	1639	
3.	*Padrauna*	1046	
4.	Kathkuiyan	716	
5.	*Sardarnagar*	2129	
6.	Gauribazar	838	
7.	Baitappur	861	19 lac. gallons.
8.	Deoria (2 mills)	1464	
		9425	
Estimated total Production :—			
UNITED PROVINCES			116½ lac. gallons.
BIHAR			
Group I —Distillery Proposed at Hathua.			
1.	*Hathua*	1402	
2.	Sasamusa	761	
3.	Harkhua	765	
4.	Sidhwalia	640	
5.	Marhowra	939	
6.	Tankuhi	905	
		5412	
Group II.—Distillery Proposed at Pachrukhi.			
1.	*Pachrukhi*	1114	
2.	Maharajganj	300	
3.	New savar	919	
4.	Indian Savan	602	10 lac. gallons.
5.	Sitapore	746	
6.	Bhatni	726	
7.	Mairwa	784	
		5191	
Group III—Distillery Proposed at Narkatiaganj.			
1.	*Narkatiaganj*	827	
2.	Bagaha	695	
3.	Harinaga	1354	
4.	Chanpatia	885	
5.	Majhowli	1004	
6.	Lauriya	602	
		5367	

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1	2	3
Situation of Sugar Factory.	Cane Crushing Capacity Ton/Day.	Proposed Annual Production of Power Alcohol.

BIHAR :—*contd.*

Group IV.—Distillery Proposed at Samastipur.

1. *Samastipur* ...	764	15 lac. gallons.
2. Hasanpur ...	1010	
3. Ryam ...	736	
4. Sakri ...	673	
5. Lohat ...	1283	
6. Riga ...	961	
7. Sugauli ...	800	
8. Motihari ...	744	
9. Chakia ...	932	
10. Motipur ...	1143	
	8992	
Deduct for Miscellaneous purposes ...	1500	Corresponds to about 5 000 tons of molasses.
	7492	

South Bihar factories may be reserved for supply to Bengal and other miscellaneous purposes. After the erection of Warisaliganj is complete, the establishment of a half a million or a million gallon power alcohol distillery in South Bihar according to the surplus of molasses available, may be considered.

Estimated total production for Bihar ....45 lac. Gallons.

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BENGAL :—

Distillery Proposed at Darsana.

1. Gopalpur ...	1250	7½ lac. gallons.
2. Beldanga ...	400	
3. Plassey ...	600	
4. *Darsana* ...	1500	
	3750	

BOMBAY :—

Group I.—Distillery Proposed at Maharashtra.

1. *Maharashtra* ...	1100	6½ lac. gallons.
2. Godavari ...	750	
3. Changdeo ...	350	
4. Somaiya ...	750	
5. Belvandi ...	300	
	3250	